

Ecological Stewardship of College Lands

**Environmental Studies Senior Seminar
Fall 2002**

**Nan Jenks-Jay, Instructor
Diane Munroe, Environmental Teaching Associate**

**Grace Brooks
Douglas Dagan
Ben Hayes
Yuka Higashino
Lorna Illingworth
Glenn Olds
Haley Olinger
Devon Sigman
Susan Simpson
Tim Weston
Andrew Zimmerman**

Please do not cite or reproduce without permission of the
Middlebury College Environmental Studies Program

Table of Contents

Acknowledgements	iii
Executive Summary	iv
Chapter 1. Introduction	1
Chapter 2. Scientific Research and Teaching Sites on College Land	5
Chapter 3. Agricultural Stewardship of Middlebury College Lands	27
Chapter 4. Green Certification of Middlebury's Forests: The Future of Stewardship on Campus?	38
Chapter 5. Conclusion	47
<i>Appendix A - The Nature Conservancy's Site Conservation Planning Framework: Proposed for Research and Educational Parcels on Middlebury College Lands</i>	48
<i>Appendix B – Intent for Research and Teaching on Middlebury College Lands Form</i>	53
<i>Appendix C – Table of Contents for Agriculture Resource Binder</i>	54
<i>Appendix D – Selected Vermont Family Forests and Land Resources</i>	55

Acknowledgements

We would like to formally thank and recognize the following individuals for their contributions to the completion of this project:

Vickie Backus
Connie Bisson
David Brynn
Tom Corbin
John Derick
Dave Ginevan
Keith Hartline
Bill Hegman
Debra Heleba
Annette Higby
Bob Huth
Nan Jenks-Jay
Andi Lloyd
Pat Manley
Diane Munroe
Carl Powden
John Roe
Tom Root
Pete Ryan
Paul Sieler
Sallie Sheldon
Steve Trombulak
Steve Weber
Andrea Woloschuk

Executive Summary

The purpose of this Fall 2002 ES 401 Senior Seminar project was to examine the management of certain Middlebury College lands in terms of its ecological stewardship. As a College that boasts environmental awareness as a Peak of Excellence, Middlebury has a responsibility to take an active role in managing its lands in an environmentally mindful way. This project looked at management of non-campus College lands in three areas: research and teaching sites, agriculture, and forestry. The goals for this project have been identified as the following:

- Raise awareness of College land holdings, and how they are used/managed
- Hold the College to a higher standard of environmental leadership in land stewardship
- Raise awareness related to environmentally responsible land use and innovative practices
- Promote ecological integrity of College lands
- Encourage the College's land-use decisions to help move Vermont and the region towards a more sustainable balance between the environment and the economy

Scientific Research and Teaching Sites

Our investigation of existing College sites led to the development of management guidelines for scientific research and teaching sites on Middlebury College lands. The current College Master Planⁱ includes research areas, but lacks a complete inventory of all research sites, as well as specific descriptions of management guidelines. Six sites were identified that are regularly used due to their proximity to campus, and their unique ecological characteristics. Beyond the site inventory, a framework was established for faculty to work in cooperation with Facilities Management to develop conservation management plans for these research and teaching sites, maintaining the natural condition of these areas consistent with their scientific and educational uses. The following are recommended regarding research and teaching sites on College land:

- Use of a standard form that documents a faculty member's intent to use a site on College land for teaching or research purposes
- Utilize the Nature Conservancy's "Framework for Site Conservation Management" to develop management plans for research and teaching areas

Agricultural Lands

Because agriculture can have significant environmental implications, the agricultural component of our research looked at the management of the land leased by the College to area farmers. This project component involved identifying these lands, comparing the College's leases with those of other large landowners in Vermont, examining agricultural practices, and interviewing farmers. The information gathered indicated that farmers leasing land from the

ⁱ Middlebury College Master Plan, Prepared by the Wallace Floyd Design Group, Boston, MA, January 2000

College are generally good stewards of the land, although there are several steps the farmers and College could take to ensure the ecological integrity of the land is protected. Based on these findings, the following recommendations should be included in future iterations of Middlebury College agricultural land leases:

- Lessees are expected to comply with Accepted Agricultural Practices (AAPs), as defined by the Vermont Department of Agriculture. These practices are required of farmers by law. The practices offer a starting point for environmental stewardship of agricultural land.ⁱⁱ
- Leases should require the use of Best Management Practices (BMPs). BMPs are site, time, crop, and practice specific guidelines that further increase the environmental stewardship of agricultural production by protecting water quality through reduction of non-point source pollution.ⁱⁱⁱ
- Implementing buffers is one of the most important steps to mitigate the negative impacts of agricultural activities on the aquatic network and watershed systems. While buffers are included in the AAPs and BMPs, the width stipulated in these documents is a function of political negotiations and compromise rather than ecosystem health. Thickly vegetated buffers, which are not mowed or plowed during the crop cultivation period, with a width of 50 feet in both crop and livestock use areas have been shown to most effectively minimize the impact of agriculture on aquatic ecosystems.^{iv} See Agricultural Stewardship Resource Binder for more information.^v
- An important aspect of agricultural stewardship is long-term commitment to the land. In order to achieve this commitment, we recommend the College lease agricultural land for extended periods of time (20-50 years) with annual reviews. Farmers will be more willing to make capital investments in improving quality and productivity of the land because they will be able to reap the benefits of their improvements in the longer term.
- In order to ensure that the stewardship standards of the College are met, it is important that the lessee's long-term business objectives are in line with those standards. To this end, we recommend the College receive a copy the lessee's business plan. A business plan is beneficial both for the farmer and for the College. The business plan is a key component in maximizing the farmer's profit and the land's productivity. The plan is important in ensuring the continued success of the farmer's business and sustainable productivity of the land. Since the components and outcomes of these plans are relevant to many fields of study at the College, where practicable, students should be involved in the planning process.
- Organic practices increase the overall health and quality of the land. In negotiating a long term lease the College should actively explore the option of developing an organic certification plan with the farmers. Changing over to organic practices not

ⁱⁱ AAP's are available from the VT Department of Agriculture, Food and Markets, (802) 828-2416; <http://www.state.vt.us/agric/AAP.htm>; and in Resource Binder

ⁱⁱⁱ BMP's are available from the VT Department of Agriculture, Food and Markets, (802) 828-2416; <http://www.state.vt.us/agric/BMP.htm>; and in Resource Binder

^{iv} Keith Hartline, Natural Resource Conservation Service Middlebury Field Office, (802) 388-6748, personal communication

^v See Appendix C for the table of contents for Agricultural Stewardship Resource Binder. Full binder available from Diane Munroe, Environmental Teaching Associate, dmunroe@middlebury.edu, (802)443-5925

only improves the health of the land and the surrounding ecosystem, but in some cases it also improves the farmers economic profit. See Resource Binder for more information.

- The dialogue between farmers and the College must be enhanced. Lease agreements should require at the minimum, annual meetings in which the College and farmers can discuss current management issues and concerns. These meetings will give the College an understanding of the relative health of the land and whether or not farmers are taking appropriate measures to minimize environmental impact. The College should consider having a representative from the United States Department of Agriculture (USDA) present at these meetings to inform the College and the farmers as to how they can improve the ecological integrity of the land and its waterways. Meeting dates and notes should be kept on file to assess progress over time.
- To avoid ambiguity and confusion, the leases should explicitly define and describe responsible actions to be taken by the farmer that not only meet the College's expectations to minimize environmental impact and protect the ecological integrity of its leased land, but that also respect the farmer's economic needs.
- Further research in the following areas is needed - nutrient management planning; use of pesticides, herbicides and fertilizers (including manure); agricultural production according to soil type; and Geographic Information System (GIS) analyses of watershed-based ecological ramifications, considering such things as the efficacy of various-sized buffers, the erodability of different soil types and slopes, and the impact of different crop cover and tilling scenarios.

At the Intervale in Burlington, Vermont, which sublets land to farmers and requires them to follow strict stewardship standards, research is currently being done regarding leases for agricultural land that enable farmers to be profitable while at the same time maintaining the ecological integrity of the land (Andrea Woloschuk of the Intervale Foundation, personal communication). The Intervale is working in association with Attorney Annette Higby, Landlink Vermont, and the New England Small Farm Institute. The report should be completed in September 2003. Middlebury College should obtain a copy of this report and determine if and how this research might be applicable to the College's leases of agricultural land. See Agricultural Stewardship Resource Binder for contact information.

Forest Lands

The purpose of the forestry management component of our project was primarily to research different forestry certifications and integrated forest stewardship models to provide the basis for Middlebury to develop its own standards that reflect its goals and values. The group researched the history of Middlebury's forested lands, interviewed professors and foresters about forestry possibilities for the future, and researched different sustainable forestry certification standards. This group found that people's opinions differed on the value of one certification over another, and even the importance of certifications in general. The group concluded, however, that forestry certification is important in demonstrating Middlebury's commitment to sustainability, especially in light of the College's emphasis on using timber from its own lands in campus construction, and its position as a model for other institutional forest landowners. Those

working on the forestry component recommend that Middlebury College follow the principles and standards of both the Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI), qualifying forested parcels for certification under both programs, and also develops integrated standards that would:

- Provide managerial standards for loggers
- Spread social and economic benefits
- Provide example for other institutions, students, and land managers in the future

In addition to the recommendations made by each sub-group, the class developed two general recommendations to the College regarding its land management:

- First, we recommend an increased dialogue between all College land stakeholders including Facilities Management, Facilities Planning, the College Forester, farmers, administrators, faculty, and students.
- Second, we recommend the formation of a Lands Committee, which would facilitate the increased dialogue recommended above. This committee would allow all stakeholders to develop land management goals that appropriately reflect the College's values, and ensure that these management goals are met. The Lands Committee would include the following positions: College Forester, Director of Environmental Affairs and Planning, Environmental Studies Program Director, a representative from both Facilities Planning and Facilities Management, a faculty member from the Biology Department with a background in ecology, and a student representative. This committee would meet annually, as well as whenever a pertinent land management issue arose and would report to the Executive Vice President and Provost.

As one of the largest private landowners in Addison County, Middlebury College has the opportunity to greatly influence environmental awareness in the immediate region and in Vermont as well as the colleges and universities that look to Middlebury College as a model. We hope that the College will build upon this class' work and that the College community will take a more active role in ecologically responsible land stewardship.

Respectfully submitted by the students of the Fall 2002 Environmental Studies Senior Seminar

Grace Brooks '03
Douglas Dagan '03
Ben Hayes '03
Yuka Higashino '03
Lorna Illingworth '03
Glenn Olds '03

Haley Olinger '03
Devon Sigman '03
Susan Simpson '03
Tim Weston '03
Andrew Zimmerman '03

Chapter 1. Introduction

Middlebury College as a liberal arts institution is committed to environmental mindfulness and stewardship in all its activities. This commitment arises from a sense of concerned citizenship and moral duty, and from a desire to teach and lead by example. The College gives a high priority to integrating environmental awareness and responsibility into the daily life of the institution. Respect and care for the environment, sustainable living, and intergenerational responsibility, are among the fundamental values that guide planning, decision making, and procedures. All individuals in this academic community have personal responsibility for the way their actions affect the local and global environment.

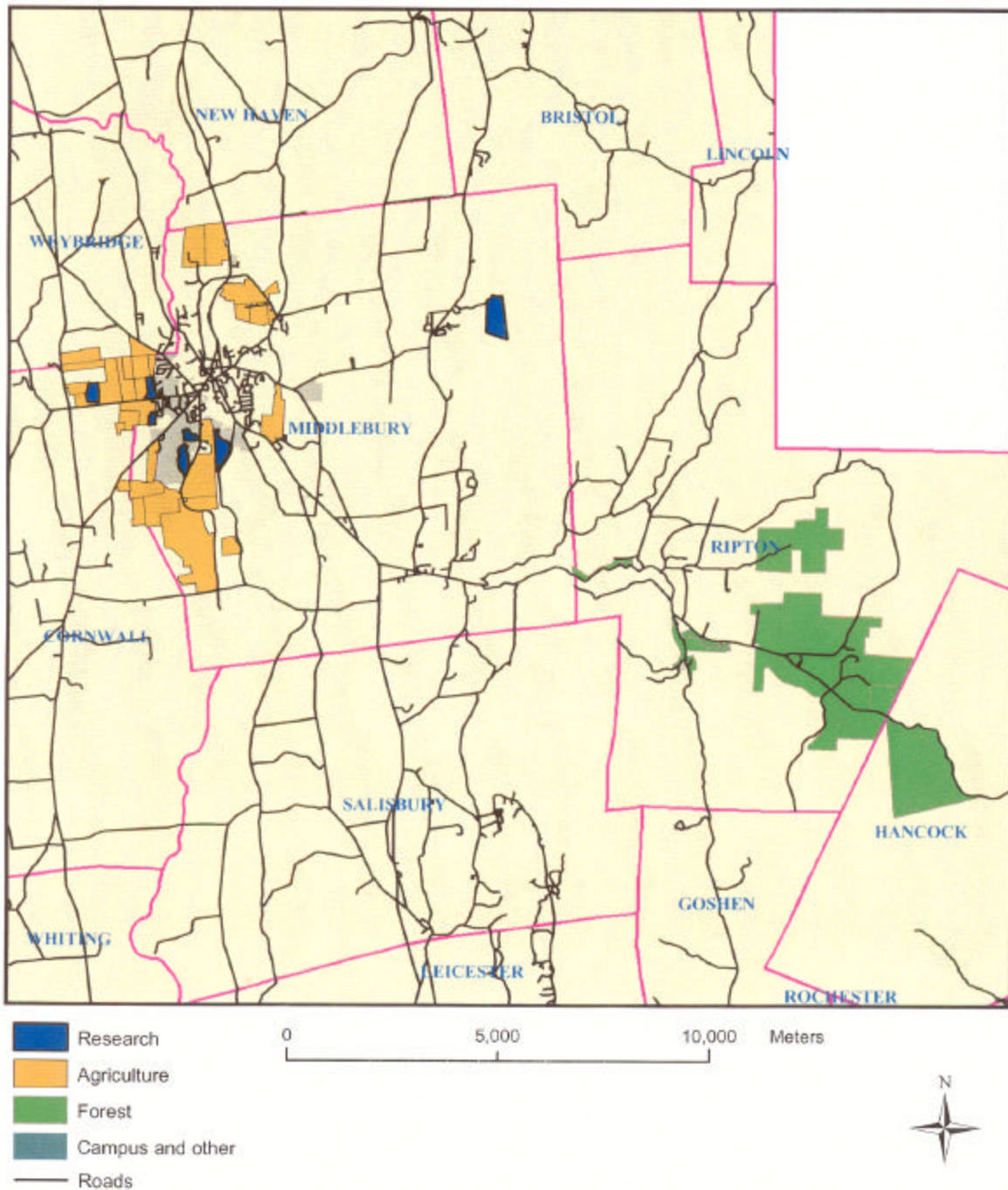
Adopted by Middlebury College's trustees in 1995, this statement demonstrates the College's commitment to the environment. One of Middlebury's identified six Peaks of Excellence that distinguishes the school from other liberal arts colleges is its environmentally aware campus. As the first institution to offer an undergraduate degree in environmental studies, Middlebury has for many years been a model for other colleges. But being "green" entails more than having an excellent environmental studies program. In order to uphold its Environmental Peak of Excellence, the College must also act as a model of environmental stewardship.

Our class believes that a careful examination of the management on all the College's lands is a natural extension of this commitment. This project looked at the ecological management of College lands in three specific areas: research and teaching areas, agriculture, and forestry. The College is fortunate enough to own several thousand acres of land, in addition to the immediate campus, there are approximately 4000 acres of forested land, 1600 acres of farmland leased for agriculture, and 150 acres used for research and teaching (not including research sites in the Bread Loaf area) (Figure 1). The goals for this project have been identified as the following:

- Raise awareness of College land holdings, and how they are used/managed
- Hold the College to a higher standard of environmental leadership in land stewardship
- Raise awareness related to environmentally responsible land use and innovative practices
- Promote ecological integrity of College lands
- Encourage the College's land use decisions to help move Vermont and the region towards a more sustainable balance between the environment and the economy

Figure 1

College Land in the Greater Middlebury Area



Our investigation of College research and teaching sites led to the development of management guidelines for scientific research and teaching sites on the Middlebury College lands. The current Middlebury College Master Plan^{vi} lacks a complete inventory of all research and teaching sites, as well as specific delineations of management guidelines for these areas. The scientific research and teaching sites were identified by querying professors of the College's science departments to determine what areas have been or are currently being used for research or outdoor labs. Through this correspondence, six sites were identified that are regularly used due to their proximity to campus and their unique ecological characteristics. At present, the sites are used by faculty and students in many academic disciplines, including biology, geography, geology, and environmental studies. The goal for this project component was to create a more thorough inventory of College-owned natural areas currently used for scientific and educational purposes and to apply the Nature Conservancy's land management framework to one site as an example of an appropriate management strategy for the College to use. Beyond the site inventory, a framework was established for faculty to work in cooperation with Facilities Management to develop conservation management plans for these natural parcels and maintain the natural condition of these areas consistent with their scientific and educational uses. For more information and recommendations, see Chapter 2 – Scientific Research and Teaching Sites on Middlebury College Land.

The agricultural component of our research examined the management of the land leased by the College to area farmers, recognizing the significant environmental implications it can have. This project involved identifying these lands leased for agriculture using GIS maps, comparing the College's leases with those of other large landowners in Vermont, researching agricultural practices and their associated impacts, and interviewing farmers about the current use and health of the land. The information gathered indicated that farmers leasing land from the College are generally good stewards of the land. We also found the Accepted Agricultural Practices (AAPs) - which are required by Vermont State Law - are not enforced, and that the United States Department of Agriculture (USDA) offers several programs to assist farmers in becoming better ecological stewards of the land. Based on these findings, the group made several recommendations to the College regarding its agricultural leases. To see more about this research and its recommendations, see Chapter 3 - Agricultural Stewardship of College Lands.

^{vi} Middlebury College Master Plan, Prepared by the Wallace Floyd Design Group, Boston, MA, January 2000

The primary purpose of the forestry management component of our project was to research and compare the Forest Stewardship Council's and the Sustainable Forestry Initiative's forestry certification standards, both with each other and with the integrated forest stewardship model of Vermont Family Forests, to provide the basis for Middlebury to develop its own standards that reflect its goals and values. In addition, the history of Middlebury's forested lands was researched and professors and foresters were interviewed about possibilities for the future of these forested lands. This group found that people's opinions differed on the value of one certification over another, and even the importance of certifications in general. The group concluded, however, that forestry certification is important in demonstrating Middlebury's commitment to sustainability, especially in light of the College's emphasis on using timber from its own lands in campus construction, and its position as a model for other institutional forest landowners.

In addition to the recommendations for each individual group, the class developed general recommendations for management practices on College land. These recommendations are to increase the dialogue between College land stakeholders and the formation of a Lands Committee to deal with management decisions.

Chapter 2. Scientific Research and Teaching Sites on College Land

By Yuka Higashino, '03; Lorna Illingworth, '03; Haley Olinger, '03; and Devon Sigman, '03

Introduction

In “Pathways to a Greener Campus,” the Middlebury College Environmental Council states: “*Through sound management and stewardship of its valuable land resource, the College demonstrates practicable conservation and recognizes and seeks to preserve the value of diverse ecosystems.*”^{vii} Our project calls upon Middlebury College to enact such stewardship and responsibility in relation to areas on College-owned land that serve as scientific research and educational sites. Despite its tradition of environmental leadership and awareness, Middlebury College lags behind in the identification, protection, and management of these important natural areas. Therefore, we define steps the College should take to recognize the ecological and educational significance of these sites, to protect these sites under its stewardship, and to minimize the impacts of disturbance on the natural systems.

The 2000 Middlebury College Master Plan, prepared by the Wallace Floyd Design Group, lacks a complete inventory of all research and teaching sites, as well as site-specific delineations of management guidelines and the implications of such guidelines for the scientific and educational work conducted in these natural systems. By communicating with professors in the College’s science departments and environmental studies program, we created a more thorough inventory of the most prominent natural areas on College land that are used for academic purposes. We determined six sites that are regularly used due to their unique ecological characteristics, their proximity to campus, and/or because the land is College owned. Currently faculty and students in many academic disciplines use these sites, including biology, geography, geology, and environmental studies. These six areas include (See Figure 1):

- Wetland, forest, and geophysical site west of Bicentennial Hall
- Deciduous and coniferous forests near the College golf course
- Otter Creek Floodplain Forest
- Clayplain forests west of campus off Rt. 125
- Battell Research Forest in East Middlebury
- Bread Loaf Campus area in Ripton

^{vii} A 1995 report of the Middlebury College Environmental Council chaired by Steven Rockefeller

The inventory for each research and teaching site includes a map and location information, a site description, the names of the professors and courses that are currently using the site, information on the type and duration of research occurring at the site, the site's ecological characteristics, its significance to teaching or research, and suggestions from the professors about land management for the site. This inventory should serve both future master plans and the interests of educators.

We then borrowed The Nature Conservancy's *Site Conservation Planning Framework* (Appendix A) as a template for developing management plans for College research and educational sites and applied it to the College's Otter Creek Floodplain Forest research site. The resultant plan should be put into effect by College land administrators and should serve as an example plan for the other research and teaching parcels.

Lastly, communication and collaboration is vital in land management decision-making, in order to consider the needs of all stakeholders. We developed and recommend the use of a form that documents a faculty member's intent to use a site on College land for research or teaching purposes (Appendix B). This form should help facilitate a dialogue between land managers and faculty involved in each site, to ensure that there are no violations to the ecological integrity of the natural systems that disregard their inherent value and their scientific and educational use.

Inventory of Six College Research and Teaching Sites

Site 1. Wetland, forest, and geophysical site west of Bicentennial Hall

Location: 73°10'65"W/ 44°0'17"N: Three sites west of Bicentennial Hall are currently being used for scientific research. The *wetland* is bordered by Bicentennial Hall on the east and College-leased farmland on the west. The *forest* is located between Blinn Lane and Bicentennial Way and the *geophysical field site* is located directly west of Bicentennial Hall and east of the wetland (Figure 2).

Site Description:

- **Wetland:** Class II Wetland. Farming practices on abutting College-leased land have affected the health of this wetland through drainage ditching and other practices^{viii}
- **Forest:** Mixed deciduous and coniferous forest with a nearby stream
- **Geophysical field site:** Mowed field with buried metal barrels used for geophysical research

Professors, courses, and students currently using or who have used these sites:

Wetland

- BI 201: Invertebrate Biology: Tom Root, Biology Department
- BI 216: Animal Behavior: Tom Root, Biology Department
- BI 302: Aquatic Ecology: Sallie Sheldon, Biology Department
- GL 257: Soil Geology and the Environment: Pete Ryan, Geology Department
- GL/GG 255: Surface and Groundwater: Pete Ryan, Geology Department
- Environmental Studies Independent Project: 2000: "Wetland Assessment and Restoration at Middlebury College, VT." Lara DuMond '00 (Mary Gaudette, Advisor)

Forest

- Glenn Olds '03 and Joseph Schine '03 for the student organization, The Keepers – a student organization dedicated to passing on the endangered knowledge of native skill: tracking, shelter building, matchless firemaking, edible and medicinal plants, awareness, etc.

Geophysical field site:

- GL 382: Geophysics: Pat Manley, Geology Department
- GL/GG 255: Surface and Groundwater: Pete Ryan, Geology Department

Duration and Purpose of Study:

Wetland

- BI 201: Fall: used since 2000, approximately two times per semester to collect invertebrates.
- BI 216: Spring: used since 2000, at least 3-4 times per semester to observe black-capped chickadee feeding behavior on temporary feeders. Additional feeders are set up on adjoining natural areas surrounding the College.
- BI 302: Fall: used since 2002, 2-3 times per semester, for wetland delineation labs and independent project work.
- GL 257: Spring: used since 2000, to study and compare soils between wetlands and agricultural land.
- GL/GG 255: used since 2000, to study the relationship between surface and groundwater.
- DuMond, 2000. Studied health of this wetland and developed a restoration plan.

^{viii} Environmental Studies Independent Project, 2000: "Wetland Assessment and Restoration at Middlebury College, VT." Lara DuMond '00 (Mary Gaudette, Advisor)

Forest

- Olds and Schine (2003) are currently using this site once a week to host an environmental education program they created, called the “Keepers”.

Geophysical Field Site

- Fall: GL 257 and GL/GG 225: use buried soil and geophysical equipment several times a semester to conduct geophysical studies.

Significance for Research and Education

- ***Wetland:*** This area is important because of it one of the only wetlands within walking distance from the Bicentennial Hall. GL/GG 225 uses this site because it has a shallow water table and can easily used to show the relationship between surface and groundwater.
- ***Forest:*** This area is important because it is located close to campus and experiences very little traffic to disrupt the environmental education program established by Olds and Schine in 2002.
- ***Geophysical field site:*** GL 257 uses this site because it can be easily accessed from Bicentennial Hall and because it has important geophysical characteristics such as exposed bedrock and a thick soil cover.

Management Suggestions:

- ***Wetland:*** Professors have noted that this site would be used for more research if it was rehabilitated and restored as a natural wetland. Recommendations for the restoration of this wetland can be found in DuMond’s Environmental Studies Independent Project, written after the construction of Bicentennial Hall, 2000. Annual reassessment and delineation of wetland borders are also suggested. (Map shows suggested boundaries according to DuMond, 2000)
- ***Forest:*** Recommendations for this site would be to avoid disturbance and protect against future impacts from development in proximity.
- ***Geophysical field site:*** Management practices should continue to facilitate access. This includes annual mowing practices.

Figure 2

Wetland, forest, and geophysical site west of Bicentennial Hall Teaching & Research Area



(Adapted from DuMond 2000)

Site 2. Deciduous and Coniferous Forests

Location:

- **Deciduous forest:** 73°10'30"W/43°59'50"N: This forest is bordered by the College-owned R. Myhre Golf Course on the West and agricultural fields on the east (Figure 3).
- **Coniferous forest:** 73°10'24"W/44°0'6"N: This site is bordered by College-owned athletic fields on the north and west, and the R. Myhre Golf Course on the south (Figure 3).

Site Description: Trees such as pine, spruce, and hemlock dominate the coniferous forest and the deciduous forest is dominated by trees such as maple, beech and oak.

Professors, courses, and students currently using or who have used these sites:

- BI 190: Ecology: Andi Lloyd and Sallie Sheldon, Biology Department
- BI 201: Invertebrate Biology: Tom Root, Biology Department
- BI 216: Animal Behavior: Tom Root, Biology Department
- Biology Thesis: 1994: Microhabitat use in winter flocks of Black-capped Chickadees (*Parus atricapillus*): "A comparison of foraging behaviors in an deciduous forest and a coniferous forest." Jeremy Hertzig '94 (Steve Trombulak, Advisor)

Duration and Purpose of Study:

- BI 190: Fall and spring: used since 1997: 5-6 labs per week, three weeks a semester for comparison studies and independent projects.
- BI 201: Fall: used a couple of times a semester, to compare and collect invertebrates from a coniferous and deciduous forest
- BI 216: Spring: used since before 1992, at least 3-4 times a semester to observe chickadee feeding behavior on feeders set up in different habitats

Significance for Research and Education: These two forest plots are used primarily for comparison studies and because they are within walking distance from the main campus.

Management Suggestions: No actions should be taken to disturb the forests and habitats.

Figure 3

Deciduous and Coniferous Forests Teaching & Research Area



Site 3. Otter Creek Floodplain

Location: 73°8'13"W/44°00'11"N: This site is bordered by the railroad tracks on the west, a dirt road that leads to the high school on the north, and the Otter Creek which borders the site on the south and east (Figure 4).

Site Description: This site is characterized by a mixed deciduous floodplain forest with birch, maple, oak, and basswood; a Class II Wetland; the Otter Creek; and an open field with various grass and shrub species.

Professors and courses currently using or who have used these sites:

- ES 112: Natural Science and the Environment: Amy Seidl, Environmental Studies Program
- BI 302: Vertebrate Natural History: Steve Trombulak, Biology Department and Environmental Studies Program

Duration and Purpose of Study:

- ES 112: Fall and Spring: used since 2002, approximately 3 times per week to measure carbon dioxide uptake in three different natural communities: woodland, open meadow and wetland.
- BI 302: Fall: used since 1986 for bird banding studies: 4 times/week for duration of semester, as well as 6-week mammal inventory project.

Ecological Significance:

- Unique ecosystem supporting diverse species adapted to floodplain habitat and its characteristic periodic flooding (every 5 to 10 years), seasonal changes, and nutrient and soil fluxes.
- Ongoing bird inventory research in cooperation with United States Fish and Wildlife Service: 51 bird species have been banded within the last 18 years of study by Steve Trombulak and BI 302 classes.

Significance for Research and Education: This site provides unique habitat and species diversity within walking distance from the main campus. Within this site, there are at least four completely different microhabitats (floodplain forest, meadow, wetland and creek).

Management Suggestions: With the cooperation of Steve Trombulak, land management guidelines have been produced for this site by the Fall 2002 Environmental Studies Senior Seminar (see Site Conservation Plan section of this chapter).

Figure 4

Otter Creek Floodplain Teaching & Research Area



(Diagram adapted from Calvi et al. 2000)

Site 4. Clayplain Forests

Location:

- 73°12'6.26"W/44°0'39.67"N: The clayplain forest fragment is located west of campus, off Rt. 125, abutting College-leased farmland (Figure 5).
- 73°11'3.34"W/44°0'23.55"N: Although there is currently no forest here, this site is intended for use by the Spring 2003 ES 401 seminar for a clayplain forest restoration project (Figure 5).

Site Description:

- The current clayplain forest fragment is dominated by clay soils and a mix of deciduous and coniferous trees such as hickory, oak, maple, beech, elm, pine and hemlock.
- The proposed restoration site (approximately 10 acres) is currently dominated by clay soils and a combination of grasses and sedges.

Professors and courses currently using or who have used these sites:

- GG 257: Soil Geology and the Environment: Pete Ryan, Geology Department
- ES 401: Environmental Studies Senior Seminar: Christopher Klyza, Political Science Department and Environmental Studies Program

Duration of and Purpose of Study:

- GG 257 has been using the existing clayplain site several times per spring semester since 2002 to study soil composition.
- Dartmouth College also uses existing clayplain site on an annual basis for an ongoing soils study.
- ES 401 will be involved in a clayplain forest restoration project in Spring 2003. Once established, this second site will be used as a research and teaching site for a variety of biology, geology, and environmental studies classes in the future.

Ecological Significance:

- Clayplain forests are the native ecosystems of the Champlain Valley and there are few remaining fragments. These remaining fragments are home to considerable plant and animal species diversity.^{ix}

Significance for Research and Education:

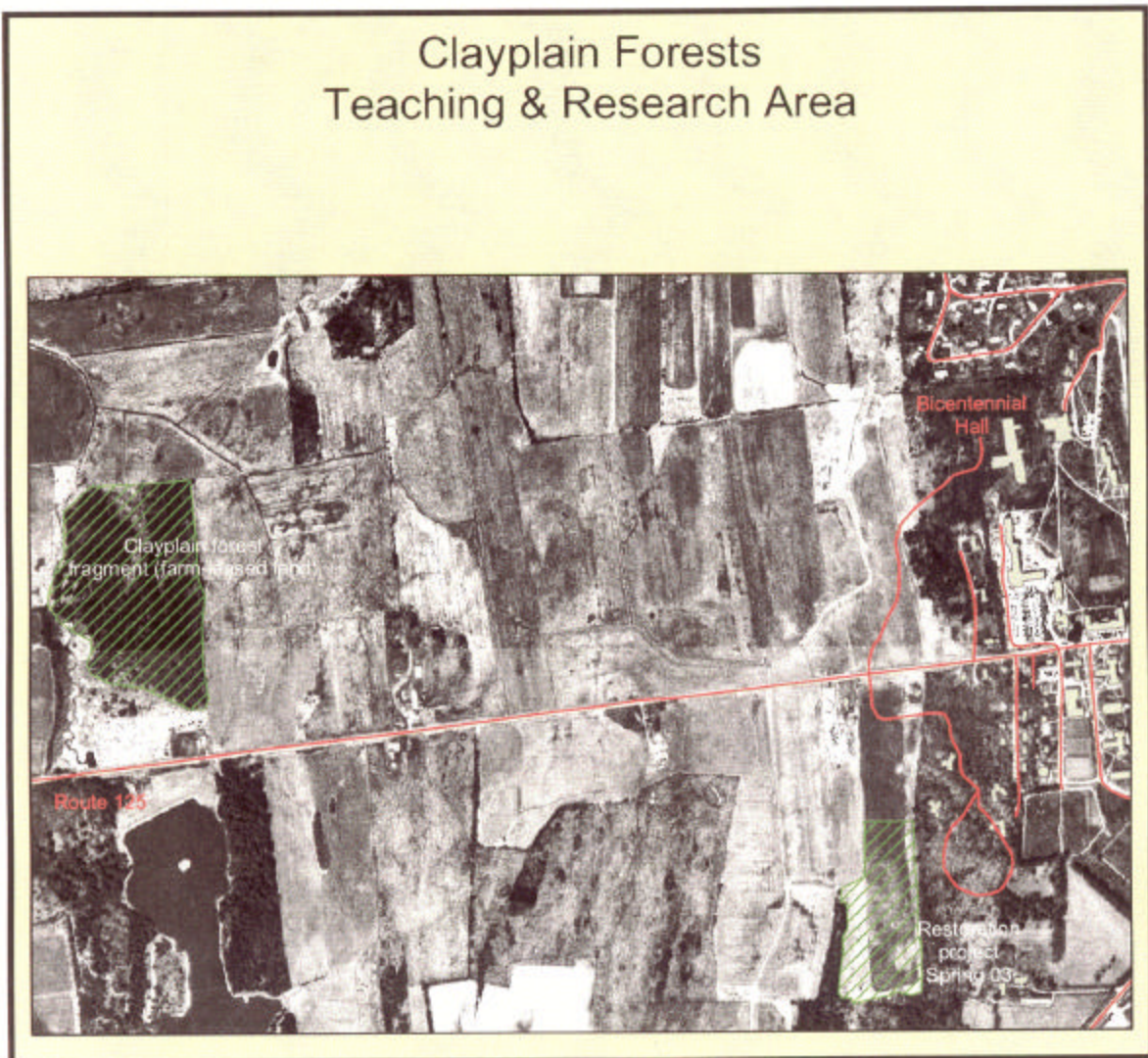
- The geology departments of Middlebury and Dartmouth College currently use these sites for ongoing soils studies. These forests are one of the few examples of non-acidic soils near campus.
- ES 401 plans to use this site because it contains all of the characteristics needed for a clayplain forest restoration project. Once complete, the restored site will provide a variety of research and teaching opportunities.

Management Suggestions:

- This current clayplain fragment would be best managed if left undisturbed.
- A management plan for the restoration site will be created by the Spring 2003 ES 401 class.

^{ix} Champlain Valley Clayplain Forest Natural History and Stewardship, Champlain Valley Clayplain Forest Project (CVCFP) 2000-2001. Available from CVCFP at <http://www.clayplain.org> or by contacting Marc Lapin at mlapin@shoreham.net

Figure 5



Site 5. Battell Research Forest

Location: 73°4'59"W/44°1'42"N: The Battell Research Forest is located east of the Middlebury College campus, along the Abby Pond Trail off Rt. 116 in East Middlebury, Vermont. The plot occurs before the bridge over Abby Brook, located on the slope between Abby and Case Brooks (Figure 6).

Site Description: This area, approximately 100 acres, was donated by Joseph Battell and is dominated by old growth hemlock and red pine ranging in age from approximately 250-350 years old.^x

Professors and courses currently using or who have used this site:

- BI 190: Ecology: Andi Lloyd and Sallie Sheldon, Biology Department
- BI 323: Plant Ecology: Andi Lloyd, Biology Department
- BI 490: Seminar in Plant Ecology: Andi Lloyd, Biology Department

Duration and Purpose of Study:

Each course uses this site, several times during the fall and spring semesters to study old growth forests. Independent work is also done during the summer.

Ecological Significance:

The Battell Research Forest is one of the last remaining old growth forests in Vermont.

Significance for Research and Education:

The Battell Research Forest is one of the last remaining old growth forests in Vermont.

Management Suggestions:

According to the bequest of donor Joseph Battell, this land should be left in its virgin form and remain uncut.^{xi}

^x Andi Lloyd, personal communication

^{xi} *Joseph Battell's Will*, Middlebury Land Records Book 38, p.38, available from the Middlebury Town Clerk's Office

Figure 6



Site 6. Bread Loaf Campus

Location: The 169 acre^{xii} Bread Loaf campus east of Middlebury College, off Rt. 125 in Ripton, Vermont has forests, meadows, and a reservoir that are used for research and teaching (Figure 7*).

Site Description: The forests are dominated by a mixed stand of deciduous and coniferous trees, primarily, maple, beech, oak, hemlock and pine and the meadow is dominated by a variety of grasses.

Professors and courses currently using or who have used this site:

- BI 201: Invertebrate Biology: Tom Root, Biology Department
- BI 323: Plant Ecology: Andi Lloyd, Biology Department
- GG 257: Soil Geology and the Environment: Pete Ryan, Geology Department

Duration and Purpose of Study:

- BI 201: Fall: used to collect invertebrates 2-3 times per semester
- BI 323: Spring: used approximately 2 weeks during the semester to study mixed deciduous ecosystems.
- GG 257: Spring: used several times a semester to compare soils in a forested and non-forested ecosystem.

Significance for Research and Education:

- Bread Loaf provides forest habitats with low levels of human disturbance on College-owned land.
- The reservoir is an important study area because it is a protected watershed with a single input and output.
- Forests, meadows, reservoir and other parts of the Bread Loaf campus serve as convenient study areas given their location and status as College-owned property.

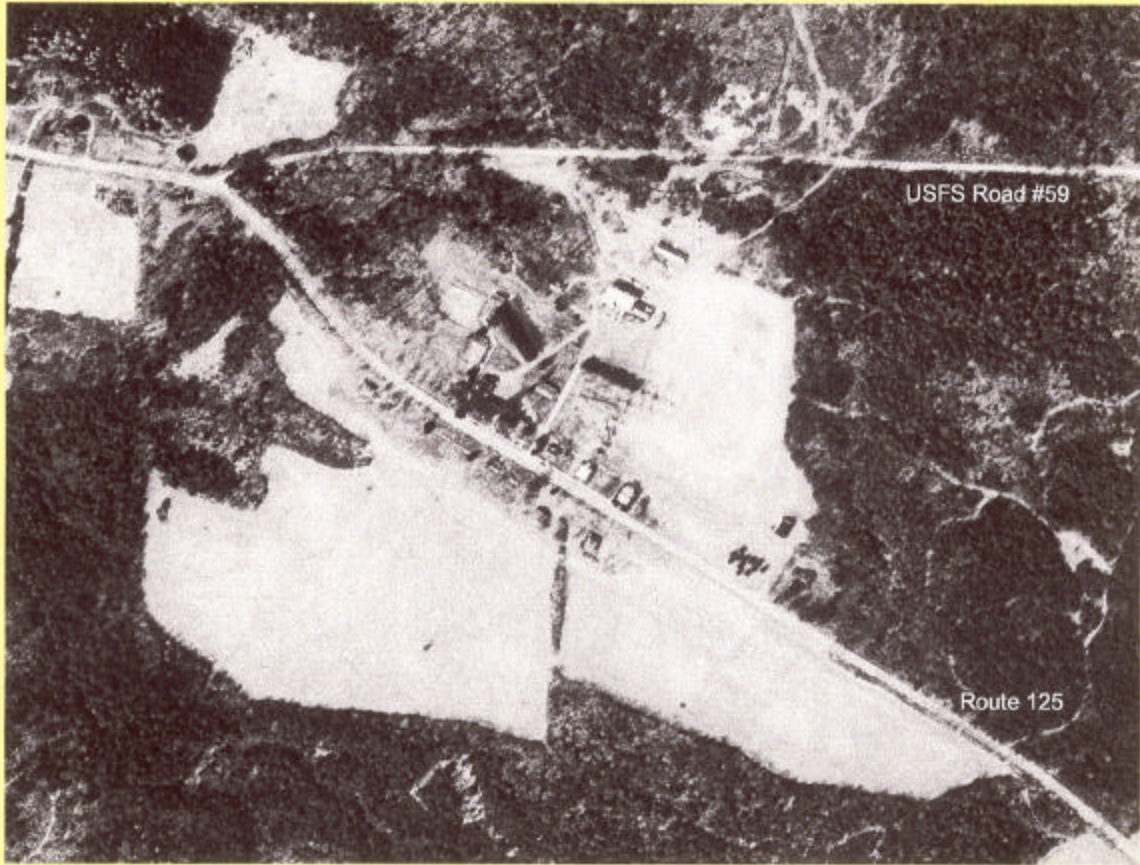
Management Suggestions:

Recommendations are to continue current management practices of periodic brush-hogging of the meadow and to minimize disturbance of the forest and reservoir areas.

* Figure 7 depicts the location of the Bread Loaf campus, and not specific research and teaching areas, as our research showed that the many portions of the Bread Loaf campus have been and continue to be utilized.

^{xii} Middlebury College Master Plan, Prepared by the Wallace Floyd Design Group, Boston, MA, January 2000

Figure 7. Bread Loaf Campus Area



Site Conservation Plan for the Otter Creek Floodplain Forest Research and Teaching Site

We employed the *Site Conservation Planning Framework* (Appendix A) that was developed by the Nature Conservancy (TNC) to recommend management strategies for the Otter Creek Floodplain Forest parcel on Middlebury College land (Figure 4). Site conservation planning within the TNC framework recommends preliminary goal setting, investigation of the site and its potential threats, communication and collaboration between stakeholders in implementing management practices, and future progress assessments on the effectiveness of these practices. The resultant plan that follows serves as an example for College land administrators in developing future management plans for research and teaching sites on College property. Within the framework we make recommendations for land use planning and management with the following considerations in mind:

- ecological integrity
- educational value
- sustainable land use
- protection of natural/rare communities
- respect and appreciation for all wildlife
- human safety and recreation

The land use planning and management decisions for the Otter Creek Floodplain Forest parcel and for all research and teaching sites on Middlebury College land should aim to:

- affirm the College's commitment to stewardship
- preserve a healthy ecological condition
- foster land management consistent with scientific and educational use
- contribute to the College's goal of environmental leadership
- promote a long term vision of each site as a resource for the College's academic departments

Background Information

The Otter Creek Floodplain Forest parcel is privately owned by Middlebury College. The approximately 20-acre parcel is within walking distance from the main campus and harbors four distinct microhabitats and considerable species diversity. This site has distinct boundaries: it is surrounded by the railroad tracks to the west and a dirt road that leads to the Middlebury Union High School on the northern border; Otter Creek serves as a natural boundary to the south and east of the parcel. The College owns the land that is across the creek, to the north of the road

grade, and across the railroad tracks. The parcel has no human residents, nor abutting neighbors. There are no competing land issues and very little history of public use, aside from minimal fishing and walking. And lastly, there are no trails or roads that cut through the area, other than the road that is the northern boundary.

The parcel is composed of three predominant ecosystem types: a mixed deciduous forest with birch, maple, oak, and basswood, a Class II wetland, and an open field dominated by grasses. The field was originally cleared for agricultural land use, but such agricultural practices no longer occur. The area floods every 5 to 10 years, allowing for changes in habitat composition. Seasonal changes also allow for the movement of aquatic and terrestrial communities. The parcel serves as a habitat for migratory and permanent-resident birds. It is also considered a potential breeding ground for the endangered Indiana Bat (*Myotis sodalis*). Summer breeding grounds for this species have been found throughout the Champlain Valley and more specifically in the Otter Creek Swamp, which has similar habitat characteristics as the Otter Creek Floodplain Forest parcel. The floodplain can have an effect on the following areas: Cornwall Swamp, Snake Mountain, Dead Creek, the Intervale Wildlife Management Area, and Little Otter Creek.

Currently the site is used by two Middlebury College courses.

- BI 302: *Vertebrate Natural History*: Taught by biology and environmental studies professor Steve Trombulak, students in this course have carried out ongoing bird studies and bird-banding practices since 1986 in conjunction with the U.S. Fish and Wildlife Service. Over the past 18 years, 51 bird species have been banded in this parcel. These labs take place during the fall semester, at least 4 times a week, 2-3 hours per day. Since 2000, the course has also done a mammal inventory every fall semester.
- ES 112: *Natural Science and the Environment*: More recently, under Environmental Studies associate in science instruction Amy Seidl, the lab sections for this course have studied carbon sequestration three days a week in three of the microhabitats occurring within the parcel (field, wetland, and forest).

Threat Assessment

As the Otter Creek Floodplain Forest parcel and the surrounding land is privately owned by Middlebury College, threats to the parcel are somewhat limited and are posed by the College's own land management practices or by public disturbance. Construction on the site is not a very real threat since the parcel is a floodplain. Past disturbances to the site have included an incident of extensive brush hogging of the entire field by College Facilities Management, which, due to the lack of communication, altered the viability of the research and teaching site. There was also a recreational bridge that was built in 1996 by the Vermont Association of Snow Travelers (with permission of the College Forester) to cross over the Otter Creek, leading into the heart of the research and teaching site from the south. Construction ensued without state permits. At the request of Steve Trombulak, Nan Jenks-Jay, Director of Environmental Affairs, and the College Provost and Executive Vice President Ron Liebowitz, the bridge was relocated as a mitigating measure so that snowmobile and human access would not harm the research and teaching site. Finished in July of 2000, the bridge was reconstructed by the Middlebury Area Land Trust in a project led by John Derick, and now connects the Trail Around Middlebury (TAM). The TAM bridge and the road grade, both on College land, do not pose a direct threat to the research and teaching site. However, each receives considerable foot traffic from high school students, College sports teams, and the public, and offers the opportunity for increased human access to the floodplain parcel.

Threats are considered those actions that disturb the natural system and/or affect the potential for ecological sustainability and the viability of scientific research. As none of the listed threats is contingent upon one another and each affects the area in a different way, they are weighted evenly as assessment criteria for the management plan. None of the threats has a greater likelihood or immediacy of occurrence. Threats to the site include, but are not restricted to:

- Vegetative clearing that drastically alters the ecological health of the site
- Vandalism to the habitat or teaching infrastructure
- Excessive foot traffic
- Camping
- Litter
- Hunting
- Fires
- Recreational Vehicles

Stakeholder Analysis

The stakeholders involved in the conservation of the Otter Creek Floodplain Forest site include not only Middlebury College as a landowner, but also those affected by the College's land management decisions relating to the site. All stakeholders should be informed of the implementation of and/or amendments to this management plan. These entities include, but are not restricted to:

- Middlebury College Environmental Studies Program & Biology Department
 - require the protection and ensured sustainable management of the parcel if research is to be worthwhile and ongoing
 - should participate in discussion about the implementation of a management plan
 - should participate in discussion about the creation of a Lands Committee to oversee all off-campus land management
- Middlebury College Facilities Management
 - directly responsible for habitat management
 - would benefit from a clear delineation of responsibilities in managing the site
 - should participate in discussion about the implementation of a management plan
 - should participate in discussion about the creation of a Lands Committee to oversee all off-campus land management
- Middlebury College Board of Trustees
 - financially responsible for College land holdings
 - should participate in discussion about the implementation of a management plan
 - should participate in discussion about the creation of a Lands Committee to oversee all off-campus land management
- Middlebury College Facilities Planning
 - should participate in discussion about the implementation of a management plan
 - should participate in discussion about the creation of a Lands Committee to oversee all off-campus land management
- Middlebury College Director of Environmental Affairs
 - should participate in discussion about the implementation of a management plan
 - should participate in discussion about the creation of a Lands Committee to oversee all off-campus land management
- Middlebury College Department of Public Safety
 - potential role in controlling public access and investigating incidences of vandalism
- The Middlebury Area Land Trust
 - responsible for the Trail Around Middlebury (TAM) and bridge
 - should be notified about problems relating to TAM bridge

Management Recommendations (Per microhabitat)

Any physical alterations to the ecosystem should be limited to those deemed necessary by the recommendations of this management plan, the advice of a consulting forest ecologist, or at the request of the faculty member involved in research at the site, and should be undertaken by the Middlebury College Facilities Management.

Field

- Rotate in brush-hogging (or clearing) 1/5 portions of the field annually (early September), returning to each portion after 5 years
- There should be no consideration of the need to produce harvestable crops

Forest

- Seek advice from a consulting forest ecologist with expertise in forest management
- Management recommendations *might* include practices such as general thinning or removal of nonnative species to maintain the health of the forest
- There should be no consideration of the need to produce harvestable timber

Wetland

- Recognize the wetland is currently in good ecological health
- The College should take no direct action to enhance or reduce its size

Access

- The TAM bridge should remain open to public access and should be checked quarterly by a representative of the Middlebury Area Land Trust
- Should incidences of vandalism or detrimental public actions become problematic, the College has the power to instate seasonal closures of the bridge to protect the area and keep it viable for the aforementioned research and teaching purposes

Signage

- If necessary, the College should post appropriate signage asking the public to respect the natural system and infrastructure of the research and teaching site
- Sign design and placement should be done in consultation with faculty using this site

Plan Assessment and Recommendations

This management plan should be assessed in accordance with the TNC *Site Conservation Planning Framework* (Appendix A). The relative successes and flaws of the plan should be discussed by involved faculty and land administrators in a preliminary feasibility analysis, to determine whether it meets ecological and academic goals, and is within the financial capabilities and wishes of the College.

Upon implementation of the plan, assessments should be made annually or as problems arise. Each assessment should address:

- Is scientific research and education still occurring at the site? If not, why?
- Is the site experiencing its best potential ecological health?
- Is the site experiencing excessive use, either public or College-related?
- Has the management plan been followed? If not, why?
- Are the management guidelines in the plan sufficiently transparent for all involved?
- Are the results of management practices consistent with, or detrimental to, the research being done at the site?
- Are all involved parties communicating and collaborating in plan implementation?
- Are there amendments that could be made to facilitate more effective management?
- Has there been a follow-up consultation with any ecological advisors to determine if his/her recommendations are successful?
- Any other questions or problems related to the use/management of the site

The Otter Creek Floodplain Forest parcel and all other research and teaching sites would benefit from the formation of a single working group that would be responsible for all the College's off-campus land management decisions. Consistent with the agriculture and forestry components of this project, we recommend the formation of a 'Lands Committee,' which should include:

- Director of Environmental Affairs and Planning
- Director of Environmental Studies Program
- College Forester
- Representatives from both Facilities Planning and Facilities Management
- Faculty member from the Biology Department with a background in ecology
- Student representative

This committee, once formed, should receive feedback from and consult with those member/s of the science faculty and Facilities Management who are actively involved the research and management on each site. The committee should report directly to the College

Provost, President, and Board of Trustees to ensure that their decisions meet the College's financial, academic, and environmental goals.

Conclusion

We believe that Middlebury College is fortunate: its natural areas represent a significant resource that many colleges and universities have to seek out – a resource that is currently meeting, and has the potential to meet, the teaching and research needs of the science disciplines for years to come, if managed wisely. While a Middlebury College education is greatly enhanced by the opportunity to utilize its beautiful natural surroundings, growth and development is changing the face of the College community. The natural areas surrounding or in proximity to the College campus are becoming increasingly important zones of ecological integrity, educational activity, natural beauty, and reflection. The College's land management should not stop at only fostering utilization of the land resource for academic purposes, but should meet an environmental vision that ensures that the ecological health of its natural resources is ensured for future generations.

Chapter 3. Agricultural Stewardship of Middlebury College Lands

By Grace Brooks, '03; Doug Dagan, '03; and Andrew Zimmerman '03

Introduction

Middlebury College has over 1600 acres leased for agricultural production in Addison County, which is one of the few remaining primarily agricultural counties in the state (Figure 8). Acknowledging that agriculture can have significant environmental impacts, we chose to examine the management of College lands leased for agricultural purposes. Through this project we hope to encourage Middlebury College to hold a higher environmental standard, to raise awareness at the College about ecological management of agricultural lands, and to balance, as best as possible, economic and ecological considerations on College lands used for agriculture. In our effort to achieve these goals, we included a variety of stakeholders, trying to be particularly sensitive to the fact that these lands provide a way of life for the farmers in the area who lease them.

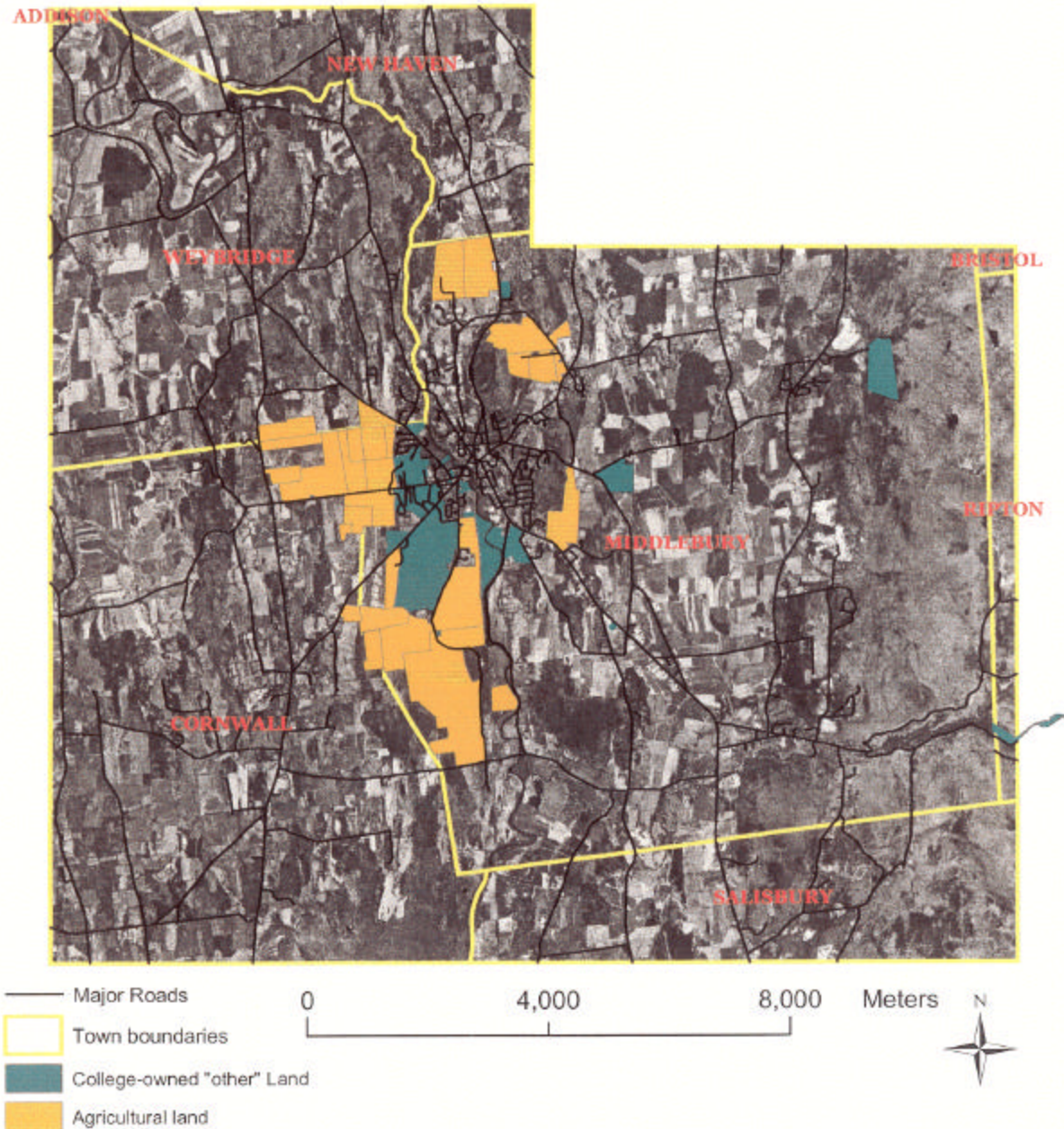
The potential negative impacts of agricultural production are soil erosion, nutrient depletion and aquatic systems degradation through nutrient loading and increased sedimentation. The agricultural land examined is within the Otter Creek watershed, which is within the drainage basin for Lake Champlain. It is estimated that about 55% of the phosphorous load delivered to Lake Champlain from non-point source runoff is due to agricultural runoff.^{xiii} Phosphorous, which is a nutrient detrimental to aquatic system health because it creates algal blooms and in turn decreases oxygen content in water, is but one of many threats to the environment posed by agriculture. As one of the largest private landowners in Addison County, the College has a responsibility to lead the region in environmental stewardship through an increased commitment to protecting the ecological integrity of both land and water.

In completing this project we identified College agricultural lands through the use of GIS for mapping and through dialogue with College Forester Steve Weber, who oversees all leasing of agricultural land. To better understand the process of leasing land we looked at sample agricultural leases from the College and those from other respected landowners in Vermont such as the Intervale Foundation in Burlington and the Vermont Land Trust. We also examined agricultural practices and their associated environmental implications. We then sought to involve

^{xiii} The Lake Champlain Basin Atlas: Phosphorous- Nonpoint Sources. Available from The Lake Champlain Basin Program at <http://www.lcbp.org> or by contacting lcgp@lcbp.org

Figure 8

College Agricultural Lands in the Middlebury Area



some of the primary stakeholders themselves by interviewing farmers to learn about the current use and relative health of the land. Finally, we used the knowledge gained from this work to make recommendations to the College regarding agricultural stewardship of College land.

Findings

Currently the College has roughly 1600 acres of land in cultivation leased by nine area farmers (Figure 9). All of the current leases include stipulations that farmers apply “good” agricultural practices because it is in the best interest of both parties to ensure long-term productivity of the land. Despite the fact that College leases do not stipulate what constitutes “good” agricultural practices, we found that the farmers we interviewed, in general, are mindful ecological stewards of the land they lease. They recognize that protecting the health of the land is ultimately in their best interest as it directly impacts their income. A consensus among the farmers was that the lower cost of leasing land from the College generally allows the land to pay for itself.

Most of this land is being used to grow feed and silage for dairy cows. Some land is used to grow corn, yet because Addison County soils are primarily clay, which retains water, the majority of the land is seeded down in hay, rye or alfalfa (Figure 10). Seeding down the land in general has less of an environmental impact than growing corn or other tillage crops in terms of soil erosion, water quality, and nutrient depletion. All farmers use crop rotation as a method to facilitate the renewal of land productivity. However, all the farmers we interviewed mentioned that weather is the most significant factor in determining productivity.

Through our contact with the United States Department of Agriculture (USDA) in Addison County, we learned the Accepted Agricultural Practices (AAPs), which are mandated by the state of Vermont as the minimum requirements to protect land and water quality, are not enforced. We also learned in addition to the AAPs, the USDA also developed Best Management Practices (BMPs), which are more restrictive than AAPs and provide for even greater water quality protection.^{xiv} The key difference between BMPs and AAPs is that the AAPs are the law and the BMPs are simply recommendations. The enforcement of AAPs is complaint-driven. This means that the United States Department of Agriculture (USDA) relies on Vermont citizens to report

^{xiv} AAP's and BMP's are available from the VT Department of Agriculture, Food and Markets, (802) 828-2416 and the Agricultural Stewardship Resource Binder for copies. See Appendix C for binder table of contents. Full binder available from Diane Munroe, Environmental Teaching Associate, dmunroe@middlebury.edu, (802)443-5925

Figure 9

Middlebury College Farmland
Current Lessees and Farm Proximity to Major Local Roads

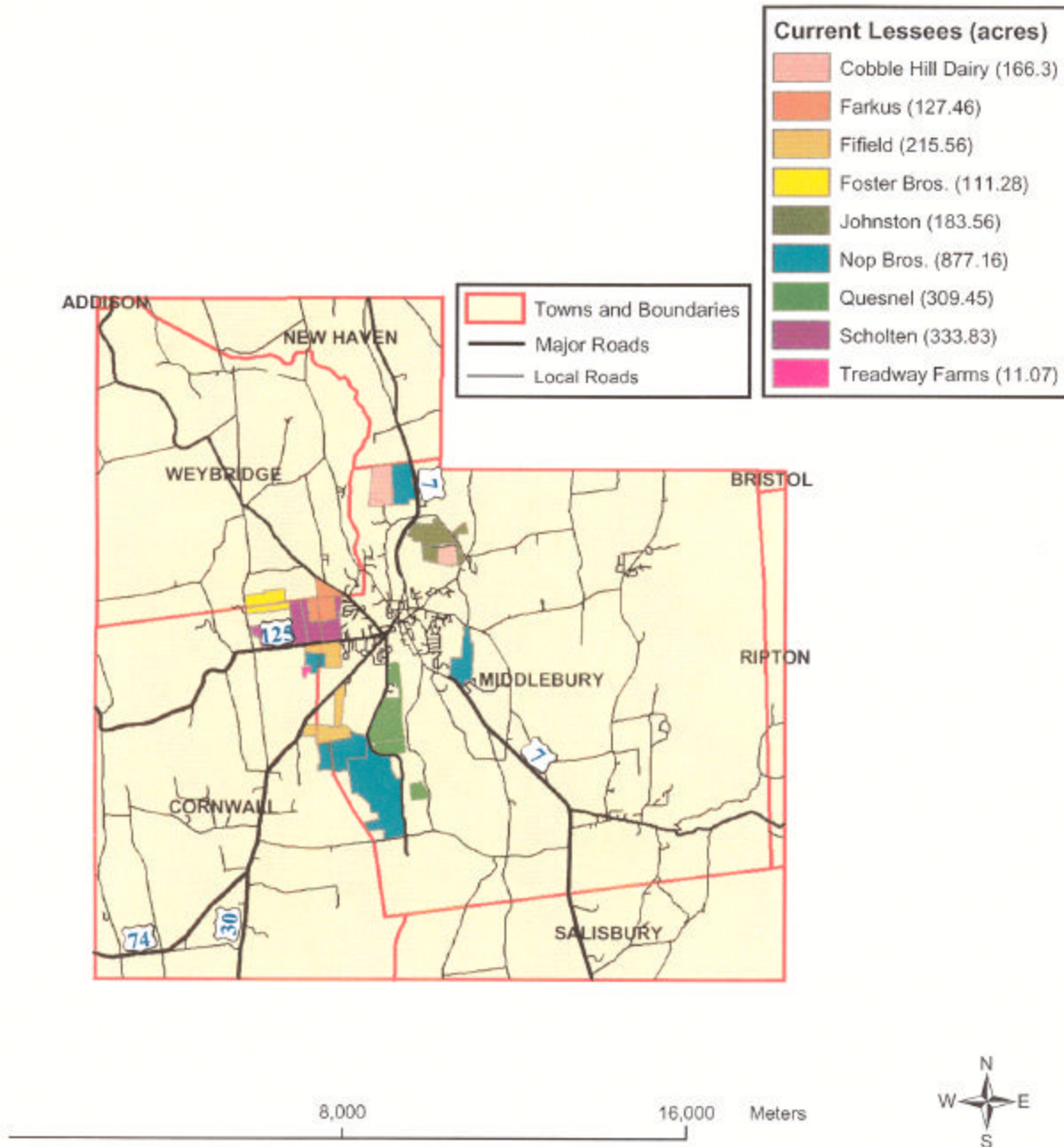
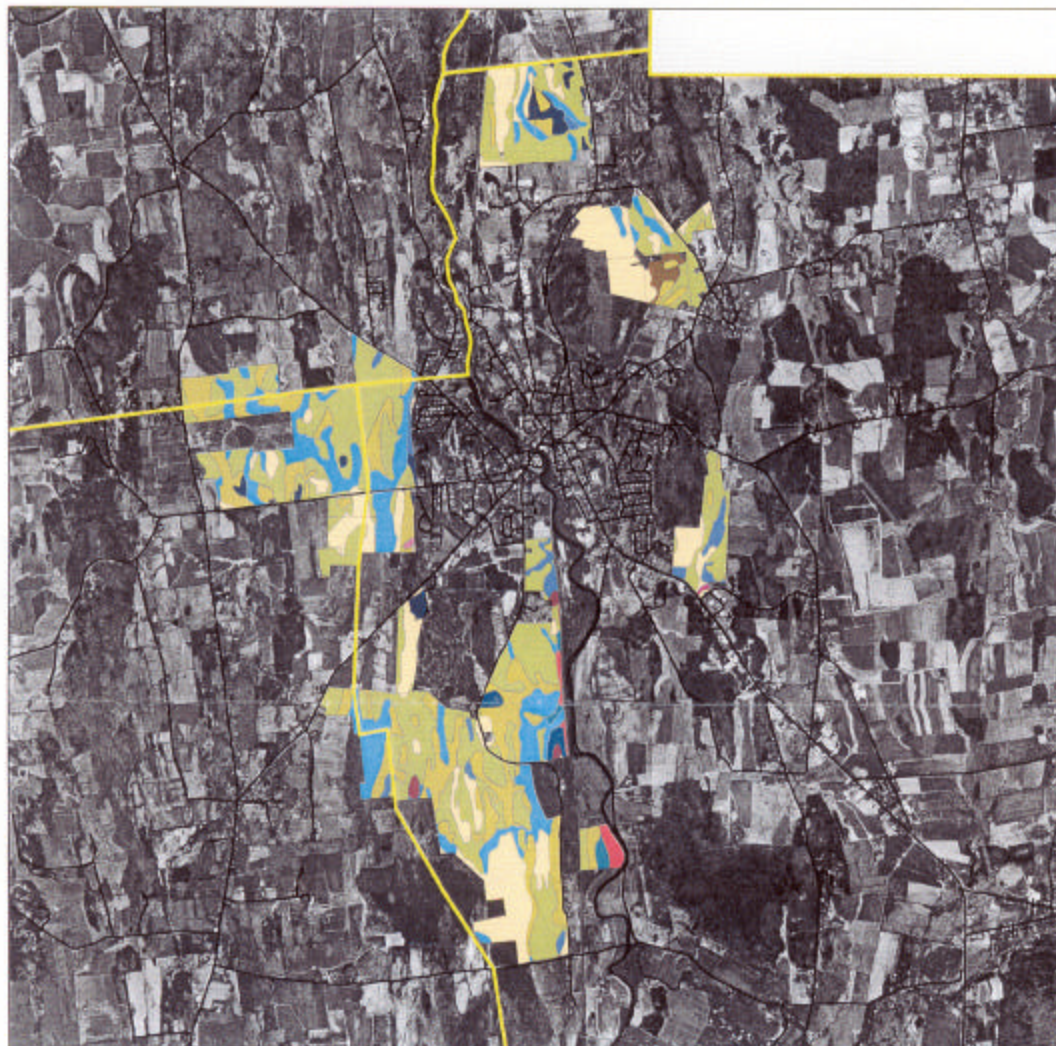


Figure 10
Prime Ag Soil Types on College Farm Land



Soil Type

- COVINGTON AND PANTON SILTY CLAYS
- COVINGTON SILTY CLAY, FLOODED
- FARMINGTON-NELLIS ROCKY COMPLEX, 5 TO 12 PERCENT SLOPES
- LIMERICK SILT LOAM
- LIMERICK SILT LOAM, VERY WET
- LIVINGSTON CLAY
- MELROSE FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES
- NELLIS STONY LOAM, 3 TO 8 PERCENT SLOPES
- NELLIS STONY LOAM, 8 TO 15 PERCENT SLOPES
- SWANTON FINE SANDY LOAM
- VERGENNES CLAY, 2 TO 6 PERCENT SLOPES
- VERGENNES CLAY, 6 TO 12 PERCENT SLOPES
- VERGENNES ROCKY CLAY, MODERATELY SHALLOW VARIANT, 2 TO 6 PERCENT SLOP
- Non-Prime Ag Soil

Data table for the soils listed and others within Addison County is available in the Agricultural Resource Binder. All pertinent characteristics as they relate to agriculture can be found in this table. For analysis purposes this map and the data table should be used in conjunction.



any infractions of the AAPs. Certain infractions can easily go unnoticed, such as buffer widths. For example, citizens typically will not identify a buffer that is 15 feet wide as opposed to 25 feet wide. This violation of the AAPs was not a problem on all College agricultural parcels, however, as many of the farmers employ 50-foot buffers even though they are not required by law. Buffers are zones of vegetation surrounding agricultural lands used to separate the agricultural land from sensitive natural resource areas, primarily rivers, lakes, and wetlands (Figure 11). These buffers minimize the environmental impact of the agricultural practices by reducing soil erosion and aquatic systems degradation caused by pesticide, herbicide, and nutrient runoff (Figures 12, 13).

The USDA funds many programs that aid farmers in their efforts to lessen environmental impacts. These incentive-based and cost-share programs are administered at a local level through the Natural Resources Conservation Service (NRCS). The programs offer assistance in a variety of areas including buffer implementation and nutrient management. An example of these programs is the Environmental Quality Incentive Program (EQIP), which identifies areas where there are significant problems with natural resources and develops conservation and restoration plans. A complete list of these programs, as well as sample leases and more information on buffers and practices, is included in the Agricultural Stewardship Resource Binder (resource binder table of contents listed in Appendix C).^{xv}

Recommendations

We recommend the following to be included in future iterations of Middlebury College agricultural land leases.

- *Lessees are expected to comply with Accepted Agricultural Practices (AAPs), as defined by the Vermont Department of Agriculture. These practices are required of farmers by law. The practices offer a starting point for environmental stewardship of agricultural land.*^{xvi}
- *Leases should require the use of Best Management Practices (BMPs). BMPs are site, time, crop, and practice specific guidelines that further increase the environmental stewardship of agricultural production by protecting water quality through reduction of non-point source pollution.*^{xvii}

^{xv} Full binder available from Diane Munroe, Environmental Teaching Associate, dmunroe@middlebury.edu, (802)443-5925, Middlebury College Environmental Studies Program.

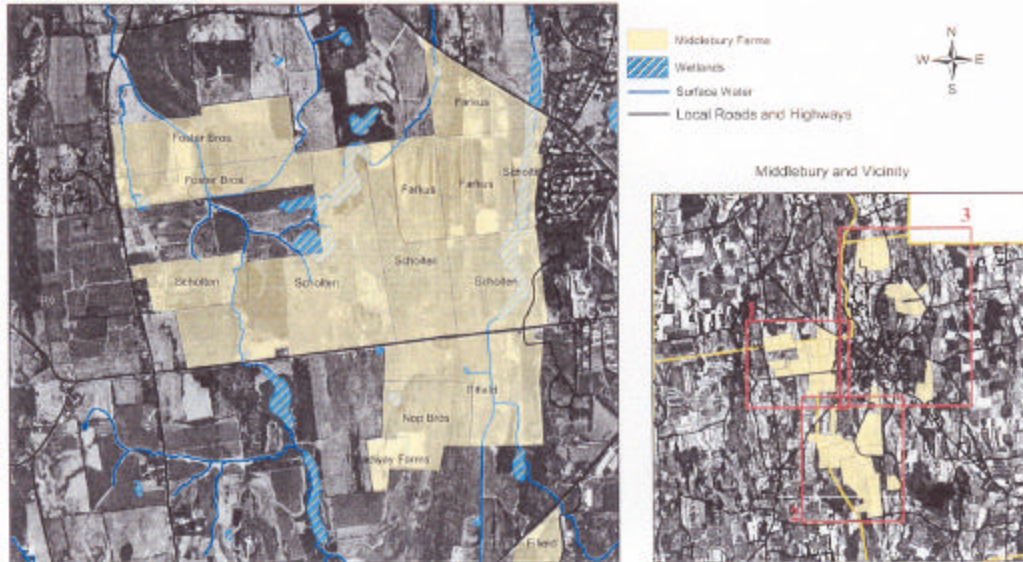
^{xvi} AAP's are available from the VT Department of Agriculture, Food and Markets, (802) 828-2416; <http://www.state.vt.us/agric/AAP.htm>; see also resource binder for copy

^{xvii} BMP's are available from the VT Department of Agriculture, Food and Markets, (802) 828-2416; <http://www.state.vt.us/agric/BMP.htm>; see also resource binder for copy

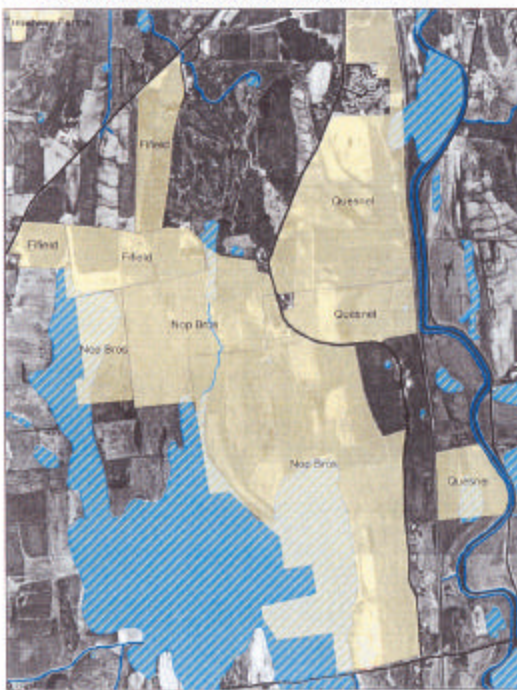
Figure 11

Lessees on Middlebury College Farmland

1 View to West of Campus



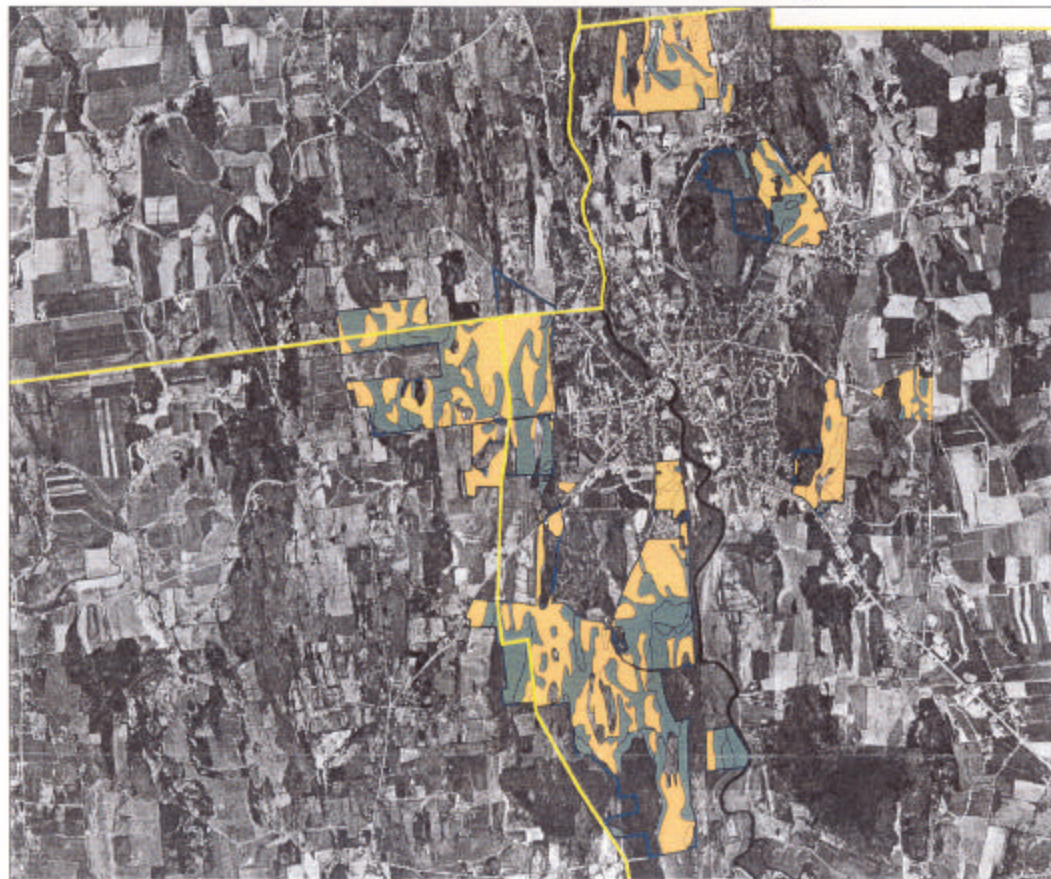
2 View Southwest of Campus between Rt. 30 and Otter Creek



3 View to the East and North of Campus



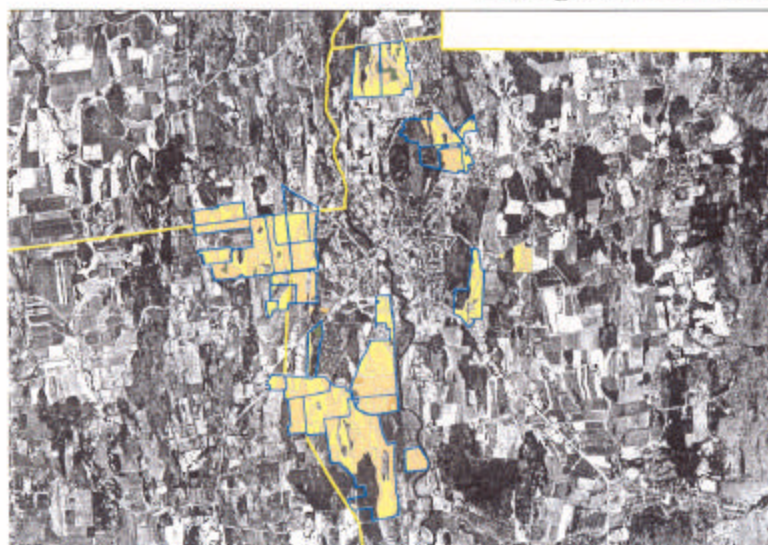
Figure 12
Soil and Erosion on College-Owned Prime Ag Land



- Town Boundaries
- Not highly erodible land
- Potentially highly erodible land

This is on a relative scale among soils being the prime agricultural land designation. Erosion potential was based on slope and soil characteristics such as clay and sand composition.

Prime Soil Designation Within College-Owned Prime Ag Land



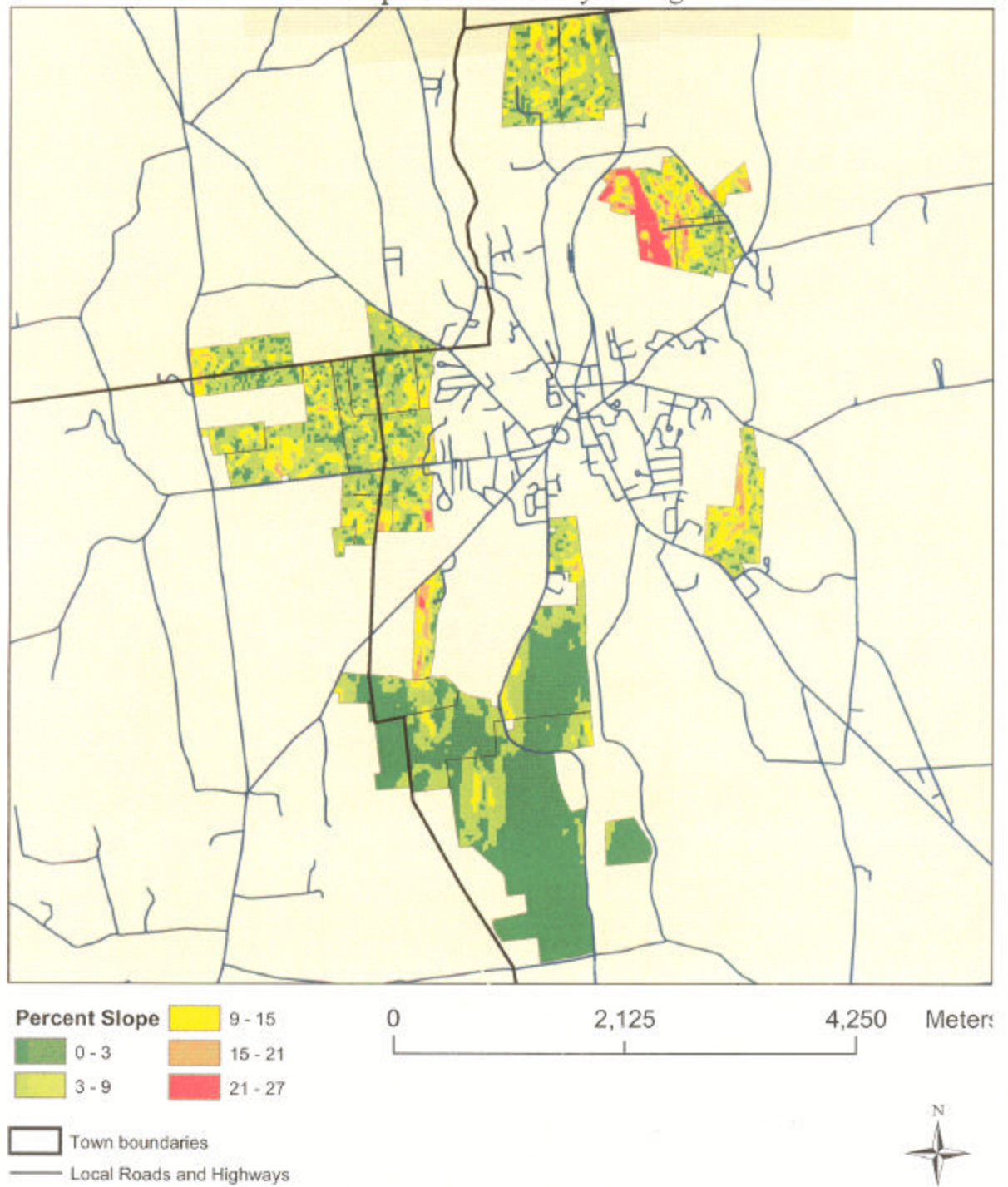
- Farm Boundaries
- Town Boundaries
- Prime Soil Designation**
- PRIME
- STATEWIDE
- STATEWIDE (b)
- STATEWIDE (c)

Prime agricultural land within Addison County is broken into the classes above. The "Prime" designation represents soil with the highest agricultural value. "Statewide (c)" represents the lowest quality soil that is considered part of prime agricultural land. The scale above, goes from best soil quality on the top to lowest within the prime agricultural land designation on the bottom.



Figure 13

Percent Slope of Middlebury College Farmland



- *Implement Larger Buffers:* Implementing buffers is one of the most important steps to mitigate the negative impacts of agriculture on the aquatic network and watershed systems in the Champlain Basin. While buffers are included in the AAPs and BMPs, the width stipulated in these documents is a function of political negotiations and compromise rather than ecosystem health. Thickly vegetated buffers, which are not mowed or plowed during the crop cultivation period, with a width of 50 feet in both crop and livestock use areas have been shown to most effectively minimize the impact of agriculture on aquatic ecosystems.^{xviii} See Resource Binder for more information.
- *Establish Longer-Term Leases with Annual Reviews:* An important aspect of agricultural stewardship is long-term commitment to the land. In order to achieve this commitment, we recommend the College lease agricultural land for extended periods of time (20-50 years), working with farmers to conduct annual reviews of the property and leases. Farmers will be more willing to make capital investments in improving quality and productivity of the land because they will be able to reap the benefits of their improvements in the longer term.
- *Provide Business Plan:* In order to ensure that the stewardship standards of the College are met, it is important that the lessee's long-term business objectives are in line with those standards. To this end, we recommend the College receive a copy the lessee's business plan. A business plan is beneficial both for the farmer and for the College. The business plan is a key component in maximizing the farmer's profit and the land's productivity. The plan is important in ensuring the continued success of the farmer's business and sustainable productivity of the land. Since the components and outcomes of these plans are relevant to many fields of study at the College, where practicable, students should be involved in the planning process.
- *Encourage Organic Practices:* Organic practices increase the overall health and quality of the land. In negotiating a long term lease the College should actively explore the option of developing an organic certification plan with the farmers. Changing over to organic practices not only improves the health of the land and the surrounding ecosystem, but in some cases it also improves the farmers economic profit. See Resource Binder for more information.
- *Increase Communication:* The dialogue between farmers and the College should be enhanced. Lease agreements should require at the minimum, annual meetings in which the College and farmers can discuss current management issues and concerns. These meetings will give the College an understanding of the relative health of the land and whether or not farmers are taking appropriate measures to minimize environmental impact. The College should consider having a representative from the USDA present at these meetings to inform the College and the farmers as to how they can improve the ecological integrity of the land and its waterways.
- *Provide Clarity:* To avoid ambiguity and confusion, the leases should explicitly define and describe the expectations the College holds for the farmers regarding management of leased lands. The leases should also clearly state the College's

^{xviii} Keith Hartline, Natural Resource Conservation Service Middlebury Field Office, (802) 388-6748, personal communication

intention to minimize environmental impact and protect the ecological integrity of the land through the responsible actions of the farmer.

- *Conduct Additional Research:* Further research in the following areas is needed - nutrient management planning; use of pesticides, herbicides and fertilizers (including manure); agricultural production according to soil type; and Geographic Information System (GIS) analyses of watershed-based ecological ramifications, considering such things as the efficacy of various-sized buffers, the erodability of different soil types and slopes, and the impact of different crop cover and tilling scenarios.

At the Intervale in Burlington, Vermont, which sublets land to farmers and requires them to follow strict stewardship standards, research is currently being done regarding leases for agricultural land that enable farmers to be profitable while at the same time maintaining the ecological integrity of the land.^{xix} The Intervale is working in association with Attorney Annette Higby, Landlink Vermont, and the New England Small Farm Institute. The report should be completed in September 2003. Middlebury College should obtain a copy of this report and determine if and how this research might be applicable to the College's leases of agricultural land. See Agricultural Stewardship Resource Binder for contact information.

Conclusion

Because the College is such a significant landowner in the region and strives to be a model of environmental awareness for other institutions, it has a moral responsibility to minimize its environmental impact. Our hope is that these recommendations, if applied, will improve the ecological integrity of these lands while fostering a community approach to environmental stewardship.

^{xix} Andrea Woloschuk, Intervale Foundation, Burlington, VT, personal communication

Chapter 4. Green Certification of Middlebury's Forests: The Future of Stewardship on Campus

By Susan Simpson, '03; Ben Hayes, '03; Glenn Olds, '03; and Tim Weston, '03

Introduction

Middlebury College has acquired its forest lands gradually, beginning with the largest acquisition – the Battell lands – in 1915. As a wealthy independent landowner, Joseph Battell used his lands for logging, recreation, tourism and preservation. His lands supplied about a dozen mills in Ripton, yet offered protection for the steep, rugged Middlebury Gorge and Otter Creek areas. When he died, he bequeathed about 30,000 acres in the Bread Loaf area to Middlebury College, for both use and preservation. Much of that land – approximately 22,000 acres – was sold in 1936 to the United States Forest Service.^{xx} As Battell decreed in his will, the College still preserves certain lands as “mountain forest in its virgin and primeval state.”^{xxi} Middlebury College also follows Battell's intent of land stewardship in managing multiple-uses on its forestland with the areas logged supplying some of the lumber used for recent College construction.

Middlebury College acquired more lands in Ripton throughout the 1960s, including acreage from William Haslett Upton, Robert Frost, and the Noble Farm.^{xxii} Today, total land ownership in the Bread Loaf area is 2140 acres, with 2020 acres managed as forestland for timber harvesting.^{xxiii} In all areas, but specifically in land management, Middlebury should strive towards the “Environmental Peak of Excellence.” With a century-long background of forest management, we think it is now important to critically examine whether or not our management actions fulfill our stated goals.

Green-certification of College-owned forest lands is one way Middlebury can progress further as an environmental institution. In general, green-certification is an intent to provide land stewards with principles of environmental, social, community, and economic sustainability.

^{xx} Goldwarg, Eric. "Man Who Buys Mountains: An Environmental History of Bread Loaf and the Joseph Battell Lands." Unpublished paper, 2000. Online from “2000 Bryan Award Finalists” 30 November, 2002. <<http://www.uvm.edu/~crvt/bryan00.html>>

^{xxi} *Joseph Battell's Will*, Middlebury Land Records Book 38, p.38, available from the Town Clerk's Office

^{xxii} Goldwarg, 2000

^{xxiii} Middlebury College Environmental Council Pathways to a Green Campus Report, 1995. Chapter 9: Land Stewardship, by **Land Stewardship Subcommittee**: Samantha D. Abeyratne '98; Timothy V. Bouton, Supervisor, Landscape and General Service Personnel, Facilities Management; Alexander P. Lee '97, Bryan T. Merrill, Crew Chief, Athletic Fields, Facilities Management; Stephen W. Weber, College Forester, Chair. <http://www.middlebury.edu/~enviroc/land.html>

Middlebury built Bicentennial Hall using green-certified, local wood of various species. Ross / La Force Hall, the adjoining Dining Hall, and the Recycling Center used wood from the Bread Loaf area enrolled in Vermont Family Forests (VFF) and certified through the Forest Stewardship Council. The successful collaboration with VFF has begun what will hopefully be a longer process of sustainable construction decisions. In the next few years, Middlebury College plans to complete the new library and Atwater residential halls and dining area. The College will next log the Crystal Brook parcel to provide wood for these projects, though it is *not yet certified*.

The College's need for lumber to supply campus construction projects is a catalyst for developing clearer policies and goals. Examining sustainable forestry and timber use and recommending certain forestry certification programs encourages the College to act with our environmental goals in mind. Understanding and making transparent the process by which we came to our actions is equally important. The fact that Middlebury considers environmental factors in all areas of management will show the integration of the Environmental Peak of Excellence.

Comparison of Timber Certification Programs

Many timber certification programs are available, however the Sustainable Forestry Initiative (SFI) and the Forest Stewardship Council (FSC) are most common in the United States today. The following mission statement excerpts point out some of the overarching goals of each practice.

The Sustainable Forestry Initiative program is a comprehensive system of principles, objectives and performance measures that integrates the perpetual growing and harvesting of trees with the protection of wildlife, plants, soil, water quality and aesthetics. Simply stated, it's working with nature to ensure the future of our forests for our children and grandchildren. And it's based on the premise that responsible environmental practices and sound business practices can be integrated to the benefit of landowners, shareholders, customers and the people they serve. The SFIsm program was developed by foresters, conservationists, scientists, professional foresters, landowners and other stakeholders, inspired by the concept of sustainability that evolved from the 1987 report of the World Commission on Environment and Development.^{xxiv}

Comparatively, the Forest Stewardship Council adheres to the following mission,

The goal of the FSC is to promote environmentally appropriate, socially beneficial and economically viable management of the world's forests by establishing a worldwide standard of recognized and respected Principles of Forest Stewardship. Their strategy is to create market demand for their products by forming buyers' groups (wholesale) in key consuming markets that make a commitment to only purchase timber products that bear the FSC logo. This mark indicates that the FSC has verified that the wood has been harvested from forests that it deems as sustainably managed.^{xxv}

The following selected principles demonstrate some of the goals of each practice.

SFI is based on the following 5 principles:

- Sustainable Forestry
- Responsible Practices
- Forest Health and Productivity
- Protecting Special Sites
- Continuous Improvement

SFI's principles are defined in 12 objectives and approximately 30 performance measures to guide managers in practicing responsible forest management. These objectives form the substance of the program and promote the following:

- Broadening the practice of sustainable forestry to all forest ownerships
- Ensure long-term forest productivity and conservation of forest resources
- Protect water quality in streams and lakes
- Protect wildlife habitats and contribute to biodiversity
- Manage visual impacts of harvesting
- Protect special sites
- Promote the efficient use of forest resources
- Encourage the use of sustainable forestry practices by forest landowners, foresters and wood producers
- Publicly report on progress in fulfilling commitment to sustainable forestry
- Promote continual improvement in the practice of sustainable forestry
- Provide opportunities for the public and the forestry community to participate in the commitment to sustainable forestry^{xxvi}

^{xxiv} Sustainable Forestry Initiative Webpage: <http://www.certifiedwood.org/>

^{xxv} Forest Stewardship Council overview: <http://www.for.gov.bc.ca/het/certification/fscopyoverview.htm>

^{xxvi} Sustainable Forestry Initiative Webpage: <http://www.certifiedwood.org/>

In contrast to SFI, FSC adds:

- Detailed, independent, performance-based forest management and conservation standards that include key environmental goals, and that must be met by all participating landowners and resource managers
- Consistent requirements for third-party audits, and independent, third-party certifiers who meet rigorous qualifications
- A chain of custody monitoring system, to ensure that products carrying the FSC label actually came from certified forests
- Transparency requirements
- A dispute resolution process that enables the public to review and appeal certifications they feel uncomfortable with
- A balanced, democratic membership that sets core FSC standards and policies, and that includes key environmental and social interest groups^{xxvii}

The SFI addresses broad ecological topics such as water quality, wildlife habitat, and special sites within forest parcels. It also promotes the improvement of sustainable forestry and efficient use of forest resources, while ensuring long-term productivity. The SFI does require periodic reports, however, this marks the extent of their public accountability.

The Forest Stewardship Council includes basic principles that go beyond the ecological goals of SFI. FSC offers consistent requirements for audits and provides a chain of custody-monitoring system, for example. They also provide dispute resolution between stakeholders and follow it with a public review process. In all of their principles, they emphasize the inclusion of social and environmental groups, which play a key role in ongoing policy-making. The FSC aims for transparency – a conscious involvement of and accountability to stakeholders – in all of its operations.

In the past, Middlebury College has worked with VFF to enroll their land and certify the timber. Vermont Family Forests is a non-profit organization that uses Forest Stewardship Council certification as a base for sustainable forestry. Their mission statement is more holistic than simply providing certification standards, and states that Vermont Family Forests exists, “To conserve the health of the forest community, and when appropriate, to promote the careful cultivation of local family forests for community benefits.”^{xxviii}

Vermont Family Forests identifies three parts of a larger system of sustainable forestry: environment, economy, and community. The most important of the three is the healthy forest,

^{xxvii} Forest Stewardship Council: <http://www.fscus.org>

^{xxviii} Vermont Family Forests: <http://www.familyforests.org>

for without it the other two would not be possible. Within the backdrop of the healthy forest, economic and community needs overlap. The overlap is where local, value-added management and intergenerational education occurs. As David Brynn, Addison County Forester and founder of VFF said, “It’s not about the tree, it’s about the people and place...and sustainable forestry.”^{xxix}

Key principles emphasize VFF's integrated approach (see Appendix D for a listing of VFF resources). They state, among other things, that people’s needs should not exceed carrying capacity, and practices should promote recycling substitution and durable timber uses. The forest as a working landscape includes interconnected reserves and public and private forests. As members of an ecological community, landowners and loggers must act together as stewards of their local forests, and constantly improve their management. Through this locally-based approach, money is kept within the community through value-added processing. Techniques such as on-site milling, employing local carpenters, and creating a market for “lower-grade” character wood promote local economic networks, thereby reducing “middlemen” and extraneous expenses. By keeping economic exchanges local, social networks can promote environmental awareness and strengthen community ties.

Discussion and Recommendations

With the previously mentioned construction of Bicentennial Hall, Ross / LaForce Hall, and the Recycling Center, Middlebury established a working relationship with VFF that demonstrated its commitment to local economic and ecological integrity. The College enrolled 345 forested acres near Bread Loaf in order to supply their construction projects with green-certified lumber with help from an ad hoc lands committee.^{xxx} Through their collaboration, they were able to change architectural plans to enable the use of Bread Loaf “character” wood for wall paneling, and were able to employ local wood producers and carpenters. In addition to the benefits to local communities, some of the most fruitful outcomes of this cooperation have been a heightened student and public awareness of Middlebury College’s commitment to its

^{xxix} Brynn, David. Vermont Family Forests Founder and Representative. 31 October 2002. Personal communication.

^{xxx} Klyza, Chris. Middlebury College Environmental Studies Program Director. 14 November 2002. Personal communication.

Environmental Peak of Excellence, as well as a demonstration to other colleges that such a local approach is a feasible option.

Crystal Brook is the next plot of College land to be logged, but currently remains *uncertified*. Its eighty acres are adjacent to the College Snow Bowl along Route 125, and will provide some of the lumber for College construction projects in the next few years (Figure 14). Topographically, the land on the slopes of the Green Mountains is steep, and the southernmost 18 to 20 acres of this plot are too steep for logging (Figure 15). There is little surface water: one stream crosses the northwest corner, and a seasonal water dip follows the slope. The forest itself includes soft maple, white birch, and beech in the prime 50 acres, a scrubby area in the north, and poor quality beech near the road and slope.

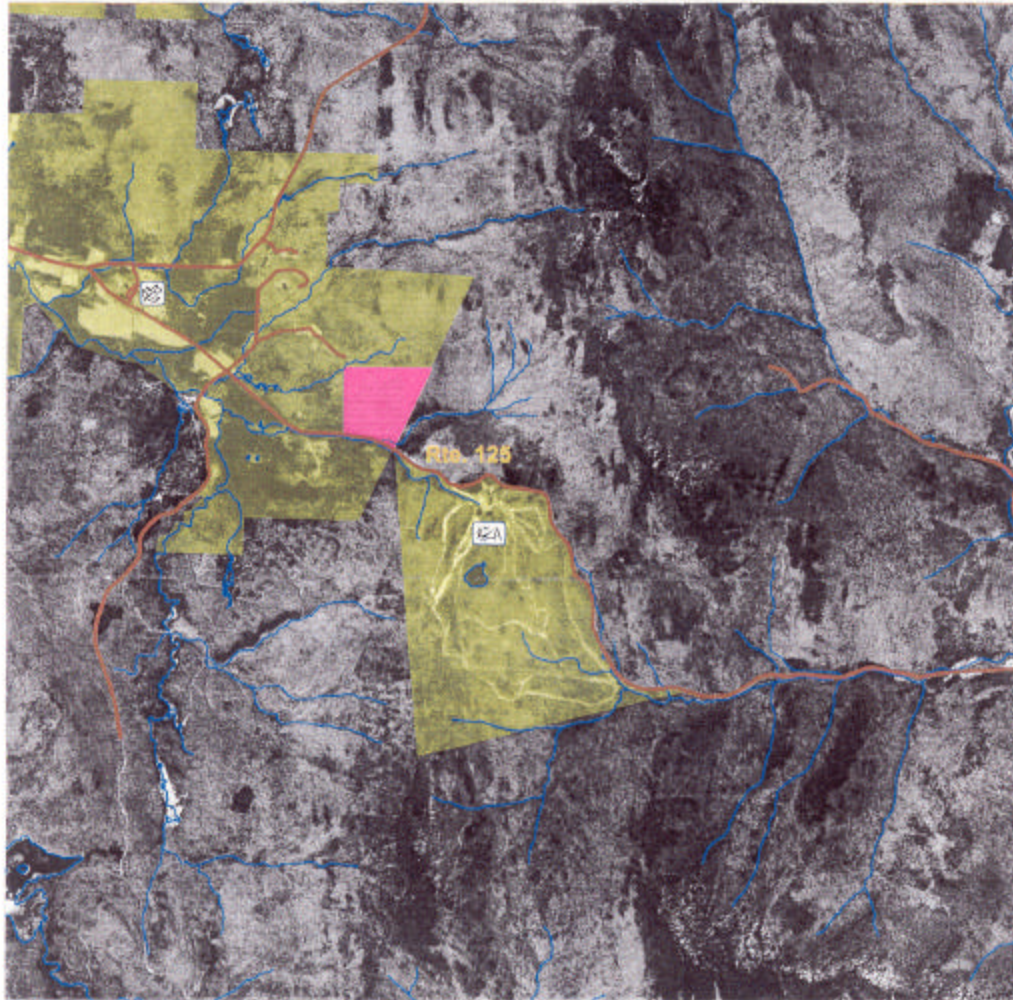
In the years from 1974 to 1976, Middlebury College hired a logger to harvest timber on the Crystal Brook plot, as well as on other College forestland near Bread Loaf. According to Steve Weber, the College Forester, the logging done was “questionable” in that it cleared only the biggest, highest quality timber.^{xxxi} Sustainable forestry would choose a variety of tree qualities, sizes, species, and ages. Yet the quality of the re-grown forest today would qualify the plot for certification under Forest Stewardship Council standards within VFF as well as under SFI standards.

Middlebury College should certify Crystal Brook and its other forest plots as soon as possible in order to continue its commitment to forest stewardship. The College prides itself on sustainable forestry practices, as illustrated by the aforementioned 345 acre plot that was certified and sustainably harvested through VFF and FSC to provide wood for Ross / La Force Hall. This plot helps to illustrate the FSC standards of selective cutting, downed “habitat” trees, waterbars on skid roads, and re-vegetation of open areas, among other things. Steve Weber stated that while all of these practices do follow FSC standards, as a responsible forester, he did these things before formal certification as well. Most responsible foresters, and certainly landowners, manage their land with long-term forest health in mind. One, perhaps overlooked, benefit of the additional certification through VFF is the assurance of Vermont branding and

^{xxxi} Weber, Steve. Middlebury College Forester. 21 November 2002. Personal communication.

Figure 14

Crystal Brook Parcel and Surrounding College-Owned Lands



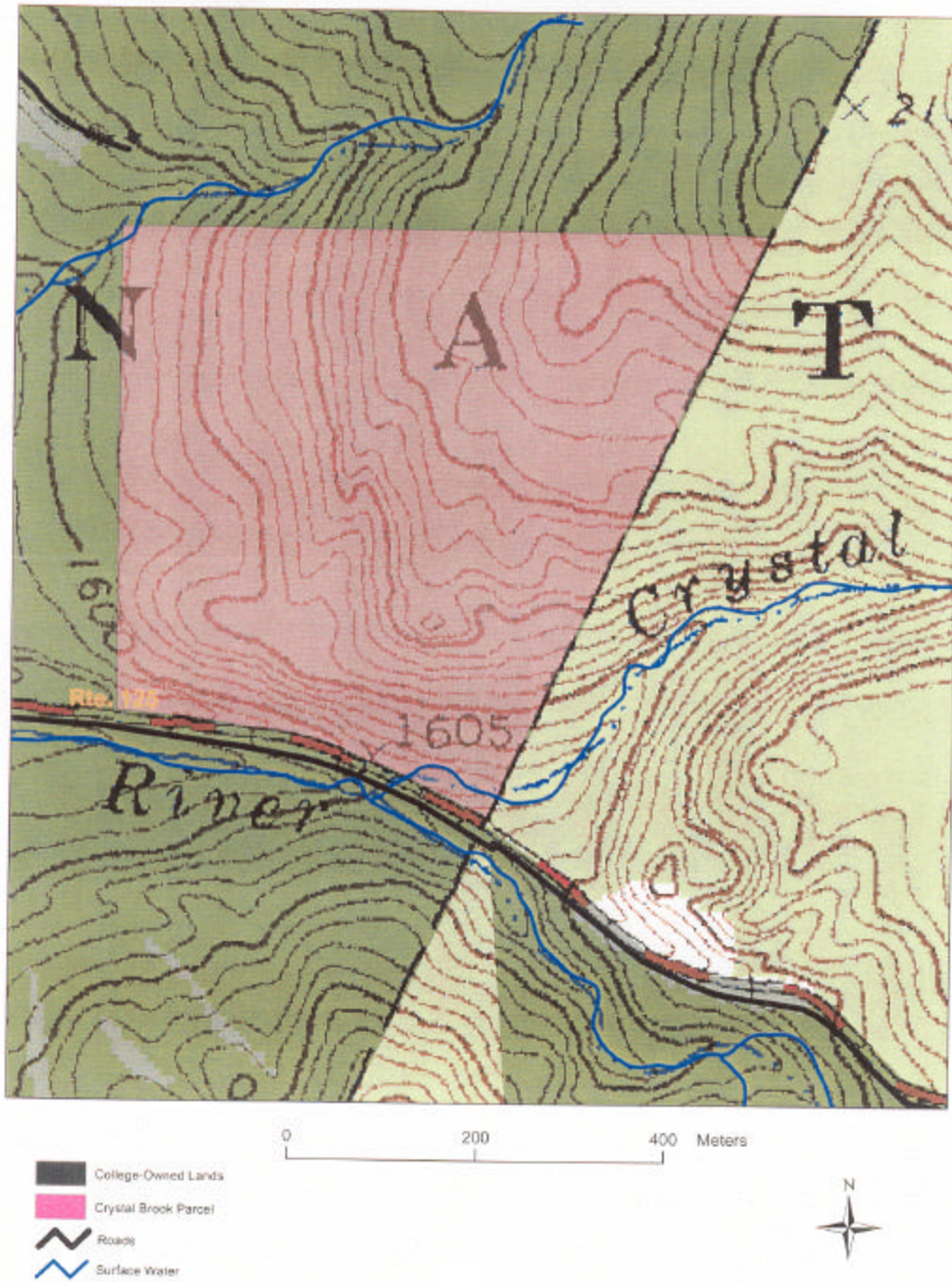
0 1,500 3,000 Meters

- College-Owned Lands
- Crystal Brook Parcel
- Roads
- Surface Water
- Breadloaf Area
- Middlebury Snowbowl



Figure 15

Crystal Brook Topographic Map



marketing. When asked how green-certification would change future operations, Weber said, “Certification doesn't affect the way we would operate.” He continued to say that a danger of certification is that it can “give the impression that all other managed land isn't up to snuff because it isn't certified.” To avoid giving this impression, Middlebury College can acknowledge responsible management now and emphasize the long-term, official stewardship ideal that green-certification brings.

We recommend that Middlebury College follow the principles and standards of both the Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI), qualifying forested parcels for certification under both programs, and also develops integrated standards that would:

- Provide managerial standards for loggers
- Spread social and economic benefits
- Provide example for other institutions, students, and land managers in the future

Conclusion

As seen in VFF's program, certification with the FSC provides certain managerial standards for loggers to follow on the ground, but it also tries to implement a larger social ethic through spreading economic benefits and responsibility for the forest. Because Middlebury College has seen poorly-managed forest practices in the past with independent, for-profit logging operations, it is important that standards exist. Middlebury College could therefore certify its forests through a broader program of ecological, economic, and social principles. We envision land managers, administrators, faculty, and students involved in the development and management of a green-certification program that is tailored to our specific land management goals. The greater impact of certification extends beyond forests; it promotes environmental education, economic investment in the local community, and social responsibility to this and future generations. While we can pride ourselves on privately following excellent forestry standards now, we could publicly promote Middlebury College's unique environmental, social, and economic principles. We recommend that in the future, Middlebury certifies its forests using standards tailored to its lands and vision.

Chapter 5. Conclusion

The class has developed two overall recommendations as a result of our research, in addition to those specific to the land use types investigated:

- First, we recommend increased dialogue between all the stakeholders of College lands, including forest management, farmers, Facilities Planning, Facilities Management, administrators, professors, and students. This will help avoid miscommunications and also ensure that the goals and expectations of all stakeholders are recognized.
- Second, we also recommend that Middlebury College form a Lands Committee. The purpose of this committee would be twofold: First, the group would establish clear goals for Middlebury's non-campus lands that reflect the College's values. Second, the committee would ensure that these goals are met on the land. Examples of these goals include seeing that those research sites identified by this class, as well as sites identified and used in the future, are managed appropriately; specifying environmental responsibilities in agricultural lease contracts; and implementing forestry certifications that reflect the College's mission.

When the College began working with Vermont Family Forests to certify College forest lands, an ad hoc committee was formed and completed tasks similar to those envisioned for this proposed Lands Committee, but it has been subsequently disbanded. The College needs a permanent structure in place to oversee non-campus land stewardship. Our class recommends at least the following positions serve on the committee: Director of Environmental Affairs and Planning, Environmental Studies Program Director, College Forester, a representative from both Facilities Planning and Facilities Management, a faculty member from the Biology Department with a background in ecology, and a student representative. This committee would meet annually to review plans and discuss revisions, and whenever pertinent management issue arise.

As one of the largest private landowners in Addison County, Middlebury College has the opportunity to greatly influence environmental awareness in the region and in Vermont. We hope that the College will build upon this class' work and that the College community will take a more active role in environmentally responsible stewardship.

Appendix A

The Nature Conservancy's *Site Conservation Planning Framework*: Proposed for Research and Educational Parcels on Middlebury College Lands

OUTLINE:

- | | |
|----------------------------------|--|
| 1) Defining direction | - Conservation targets and goals |
| 2) Assembling information | - Ecological information
- Human context information |
| 3) Analyzing information | - Threat assessment
- Situation mapping
- Stakeholder analysis |
| 4) Developing strategies | - Conservation strategies
- Conservation zones |
| 5) Outlining actions | - Implementation |
| 6) Providing feedback | - Feasibility analysis
- Measuring progress |

SITE CONSERVATION PLANNING:

1) Defining direction → Conservation targets and goals

- What do we want to accomplish?
- Why do we want to protect the area?
- What is our long-term vision for the area?

Significance of defining direction of management of a site:

- Selection of targets is key to all other planning that follows
- Conservation targets dictate the site boundaries
- Specific goals must be articulated for targets
- Goals should be clear, concise, flexible, and adaptable

2) Assembling information → Ecological information

→ Human context information

Ecological information (identify, define, and describe system elements):

- Synthesis of life history characteristics and major biological and ecological processes and patterns (natural heritage information etc.)
- Information search should be focused and driven by conservation targets and goals
- Determine appropriate scale and scope
- Develop ecological models

Human context information (social, economic, land use, and fiscal data for the site):

- Demographic profile: population, household structure
- Economic profile: unemployment rate, cost of living
- Land profile: ownership, zoning regulations, land use
- Fiscal/government profile: politics, local governments
- Cultural attitudes and values: social values, conservation values

3) Analyzing information → Threat assessment

→ Situation mapping

→ Stakeholder analysis

Threat assessment:

- Identification, evaluation, and ranking of existing and foreseeable stresses and sources of stresses that burden the system. Stresses can be ecological or human induced. Well-defined stresses should point clearly to sources.
- Assessment can be done using:
 - Numeric tables with weighing scores
 - Non-numeric tables with ranking based on qualitative assessment
 - Visually in a flow diagram analysis
- Criteria for ranking stresses and sources of stresses:
 - Severity (potential impact)
 - Scope (geographic scale of impact)
 - Immediacy (current or potential)
 - Likelihood (probability of occurring)
 - Reversibility (restoration potential)

Situation mapping:

- Development and visualization of interrelationships among ecological and human components of a system (including stresses and sources of stresses)
- Similar to developing ecological models (with cause and effect arrows and situation boxes)
- Good precursor for developing conservation strategies
- Developed by analyzing each stress defined in threat assessment
- Drawn for each stress and compiled into whole-site situation map

Stakeholder analysis:

- Examines the human communities at the site. This helps build constituencies and avoid potential pitfalls.
- Identify stakeholders:
 - Who is causing the source of stress?
 - Who would benefit from project goals?
 - Who would be hurt by project goals?
 - Who could shape public opinion about project goals?
 - Who has authority to make decisions affecting project goals
- Assess each stakeholder:
 - What effects/potential effects will project goals have on stakeholders?
 - What effects/potential effects will stakeholders have on project goals?
 - What is known/unknown about stakeholders?
- Strategies and actions to address stakeholder issues are then developed later in the planning process.

4) Developing strategies → Conservation strategies
→ Conservation zones

Conservation strategies (broad solution-oriented, innovative, and creative actions that mitigate stresses - point in process where ecological and human contexts merge):

- Differ from goals (which define desired conditions) by being broad paths that illuminate how we get there

- Several types of strategies:
 - Land protection: legal rights, acquisitions, easements
 - Management and restoration: of biological or of human effects
 - Community relations: education, regulation, partnerships
 - Programmatic: fund raising, staff, equipment
 - Research: natural systems, species, threat effects

Conservation zones (depict the geographic location for conservation strategies):

- Ideally represent different points on a continuum of active conservation management from intensive management to hands-off protection
- Will vary in number, type, and arrangement within a project

5) Outlining actions → Implementation

- Outline how conservation strategies will be accomplished.
- Addresses programmatic implication like: what, why, when, who, and how much (cost)
- Issues to consider include: required resources, staff and volunteers, research and monitoring, capital, fund raising, and budgets
- Best performed hierarchically (from general to specific), brief enough to be usable, and updated regularly

6) Providing feedback → Feasibility analysis → Measuring progress

Feasibility analysis:

- Assessing the potential for success at a site or revealing potential flaws
- Should be undertaken for all aspects of the site conservation planning process along the way
- Consider the following issues when assessing feasibility:
 - Ecological goals
 - Conservation strategies and zones
 - Stakeholder risks
 - Financial and staff resources
 - Opportunity costs

Measuring progress (monitoring and evaluating success):

- Must ask: Are our actions bringing about desired results?
- Must develop measures of progress or benchmarks to help monitor progress toward goals.
- Should include:
 - Direct biological measures
 - Abiotic measures
 - Conservation action measures (land protection and management)
 - Organization or capacity measures
- Measuring progress should include both short and long term evaluations.

Appendix B

Intent for Research and Teaching on Middlebury College Lands

Name:

Department/ Program:

Course # (if applicable):

Duration of study:

Location of Site (include map):

Purpose of Study:

Management requests:

Professor Signature: _____ Date: _____

Appendix C

Table of Contents for Agriculture Resource Binder

- Reprint of Chapter 3 – Agricultural Stewardship of Middlebury College Lands
- Copies of current leases between Middlebury College and area farmers
- Vermont Department of Agriculture, Food & Markets Accepted Agricultural Practices (AAP's)
- Vermont Department of Agriculture, Food & Markets Best Management Practices (BMP's)
- *Small Scale, Small Field Conservation*, a US Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS) publication
- *Riparian Areas: Implications for Management*, USDA-NRCS Issue Brief 13, December 1997
- *Financial, Technical, and Educational Assistance for Landowners*, USDA-NRCS Farm Bill Programs Fact Sheet
- *The Benefits of Well-Managed Stream Corridors*, University of Wisconsin-Extension Publication G3404, 1996.
- *Buffers – Common Sense Conservation*, USDA-NRCS Program Aid 1615, 1997
- *Farming and Vermont's Waterways – A Healthy Relationship*, a Vermont Department of Agriculture, Food & Markets publication
- *Vermont Organic Farmers Certification Standards and Applicant Information*, Northeast Organic Farming Association, 2001.
- *Vermont Organic Farmers Directory*, Northeast Organic Farming Association, 2001.
- *From the Land: News from the Intervale Foundation*, The Intervale Foundation Autumn 2002 newsletter.
- *The Intervale Foundation* informational brochure
- *Business Planning Courses for Agriculture Entrepreneurs* program brochure
- *Vermont Land Trust* informational brochure
- *The Intervale Foundation Capital Campaign*, 2002
- Contact Information for key area agriculture contacts
- Extra copies of GIS maps
- CD with electronic copies of GIS maps
- Soil classification data

Appendix D

Selected Vermont Family Forests and Land Resources

Vermont Family Forests (VFF)

- <http://www.familyforests.org>
- VFF resources that can be obtained by e-mailing info@familyforests.org
 - Forest Management Checklist
 - Woodlot Monitoring Checklist
 - Timber Sale Harvesting Plan, Summary, & Certificate
 - Forest Management Plan Template
 - Conserving Our Forests and Our Community: VFF Research and Demonstration Projects 2001-2002
 - VFF Annual Reports

Land Management Information:

- Middlebury College Master Plan (2000)
- Middlebury Area Land Trust: <http://snakemountainart.com/malt>
- Middlebury College “Pathways to a Green Campus Report 1995”, Chapter 9: Land Stewardship <http://community.middlebury.edu/~enviroc/land.html>
- The Nature Conservancy <http://www.tnc.org>

Ecological Context Information:

- Champlain Valley Clayplain Forest Project: <http://www.clayplain.org>
- Middlebury College Mammal Inventory Report for the year 2000, 2001, 2002
- Steve Trombulak, Professor of Department of Biology and Environmental Studies at Middlebury College
- United States Fish and Wildlife Service <http://www.fws.gov>

Human Context Information:

- Vermont Center for Geographic System (VCGI): <http://www.vcgi.org/>